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PROCESS AND DEVELOPMENT OF HERBAL TEA BAGS WITH THE INFUSION OF ETHNO MEDICINAL HERBS

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ABSTRACT

Purpose: The aim of this study is to develop herbal tea bags with the incorporation of Adhatoda vasica (Adusa) and Tinospora cordifolia (Giloy) to extend its health and nutritional benefits as they have so many attributes such as the green nature of the leaves, the antioxidant properties, polyphenol content and phytochemicals properties which make it useful for development of herbal tea bags. ***Design/methodology/approach:*** Physico-chemical, sensory and economic analysis of raw materials and final product was carried out. The process of making herbal tea is followed by the drying of leaves and other ingredients i.e. ginger and basil in hot air oven then they were coarsely grounded, mixed together and packed as dip tea bags. Nutritional analysis was done by AOAC method. ***Findings:*** Nutritional analysis showed the presence of protein, crude fat, crude fibre, carbohydrate, energy value while anti-nutritional analysis shows the presence of Phytate and Tannin. Antioxidant composition comprises total phenolics content, total flavanoid content and percent radical scavenging activity. Sensory evaluation was done by 9 point hedonic score card for different attributes like color, taste, flavor and overall acceptability. The cost of tea bags has been calculated on the basis of prevailing price of raw materials. ***Research limitations/implications***: Herbal infusions could provide a useful supplementary approach to improve certain aspects of well-being. ***Originality/value:*** The present paper showed that both the leaves have enormous nutritional efficacy which makes them unique and nutritionally adequate for development of herbal tea bags.

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INTRODUCTION

People have been consuming tea from centuries and today tea is the 2nd most favorable drink after water. Usually tea was taken to improve blood flow, remove toxins and get better resistance to diseases (Balentine *et al.,* 1997). Various epidemiological studies showed that consumption of tea are helpful in reducing the risk of cardiovascular disease, lowering the high cholesterol level, diabetes (Vinson *et al.,* 2001), arthritis (Haqqi *et al.,* 1999) and osteoporosis (Hegarty *et al.,* 2000). One of the most important constituent of tea is polyphenols which possess antioxidative, and anticarcinogenic effects (Yao *et al.,* 2004). Yerba mate is a traditional South American drink that's gaining popularity worldwide. Its polyphenol content and composition as well as the capacity of its extracts was modified by Valerga *et al.* (2012) to inhibit the oxidation of β-carotene/linoleic acid system. Apart from these benefits, tea is also rich in catechin derivatives (Horzic *et al.,* 2009). Generally four types of teas are produced worldwide as stated by Horzic *et al*. (2009) i.e. white tea, green tea (both unfermented), oolong tea (semi-fermented) and black tea (fully fermented).

Other classes of teas include puerrh tea, scented teas, flavoured teas and herbal teas. Herbal tea is the herbal infusion of boiling water and dried leaves, flowers, fruits or herbs, usually taken for its medicinal and physical effects on body (Kara, 2009). "Utazi" and "Uziza" leaves of Nigeria have medicinal properties due to which it has been successfully used for production of herbal tea (Okafor *et al.,* 2009). Adhatoda vasica (Adusa) and Tinospora cordifolia (Giloy) have so many attributes such as the green nature of the leaves, the antioxidant properties, polyphenol content, phytochemicals properties among others (Pandey *et al.,* 2016), which makes it similar to the leaves of *Camellia sinensis* and useful for tea manufacturing. Using these leaves as herbal tea forms the basis for name "Herbal Tea" often given to teas other than from the leaves of *Camellia sinensis*, because they are related with management of different ailments. Herbal remedy in the form of tea for the management of diabetes is greatly preferred to minimize the extent of disease due to its lesser side effects and low cost (Ogbonnia *et al.,* 2011). Using dehydrated leaves of Adusa and Giloy as herbal tea gives a superior option to mitigate the ill effects of health. According to Pandey *et al.,* (2016) dehydrated leaves are more concentrated in terms of chemical composition and anti-oxidant component in comparison to fresh leaves that make it feasible to make

herbal tea. In another research done by Sarkar *et al.,* (2017) Adusa leaves was taken to make herbal tea as an expectorant for the treatment of asthma.

MATERIALS AND METHODS

The present investigation was conducted in Department of Food Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad. The details of materials, experimental procedure and techniques adopted for the study are divided under the following heads which are as follows:

Experimental site: The present investigation was carried out at Department of Food Nutrition and Public Health, Ethelind College of Home Science, SHUATS.

Procurement of raw materials and identification of leaves: Healthy and fresh leaves were collected from the University Campus of SHUATS. Other Ingredients were purchased from the local market of Prayagraj. Packaging material ordered online from Amazon shopping website. Leaves of Adhatoda vasica and Tinospora cordifolia were identified by Botanical Survey of India (BSI), Prayagraj. Fresh leaves were collected, washed, blanched and left for drying 60ºC-65ºC for 8-10 hours till 6-8% moisture content. Then these leaves were grinded and stored in airtight container.

Development of herbal Tea Bags*:* Adhatoda vasica (Adusa) and Tinospora cordifolia (Giloy) along with other ingredients such as Cardamom, Ginger and Basil were used to prepare Herbal Tea Bags. Six combinations for each product were developed. It is evident that T_1 comprises 0.25g of Adusa, 1.50g of Giloy, T_2 have 0.50g Adusa, 1.25g Giloy, T_3 contains 0.75g of Adusa 1g of Giloy, T_4 consisting 1 g of Adusa, 0.75g of Giloy, T_5 have 1.25g of Adusa, 0.50g of Giloy and T_6 constitute 1.50g of Adusa and 0.25g of Giloy with a constant ratio of Cardamom, Ginger and Basil as 0.10, 0.30 and 0.35 respectively.

Organoleptic evaluation of developed Herbal Tea Bags: With the help of 9 point Hedonic Score card (Srilakshmi, 2009) sensory evaluation was done for different attributes like color, taste, flavour and overall acceptability.

Chemical analysis: Nutritional, anti-nutritional and anti-oxidant properties were determined by AOAC method (2005) to estimate the moisture, total ash, protein, crude fat, crude fiber, carbohydrate, energy, iron, calcium, vitamin C, tannin, phytate, total phenolic content, total flavanoids content and percent radical scavenging activity.

Cost analysis: The cost of the products was calculated on the basis of price of raw ingredients at rupees/gm.

Data analysis: The data were analyzed using Analysis of Variance (ANOVA) and critical difference (Gupta and Kapoor, 2002).

RESULTS AND DISCUSSION

Sensory evaluation of the herbal tea was performed for overall acceptance (color, taste, flavor and overall acceptability) by 7 members on the basis of 9-point Hedonic scale. Results regarding colour of Herbal Tea Bags have been presented in figure 1. It was revealed that T_3 (8.6) had the highest score followed by T_4 (7.7), T_2 (7.2), T_5 (6.2), T1 (5.8) and T_6 (5.2) respectively. Scores indicated that treatment T_3 was liked very much while treatments T_4, T_2, T_5, T_1 and T_6 were moderately liked by the sensory panel. Mathangi and Deivanai (2016) developed spice flavoured herbal tea. Tea was formulated with various ingredients such as cardamom, ginger, mint and coriander seed. Five treatments were prepared in which SFHT1 was found to be best in terms of colour, taste, flavor and overall accepatability. Results regarding flavor revealed that T_4 (8.2) had the highest score followed by T_3 (7.53), T_2 (7.0), T_5 (6.6), T_1 (6.2) and T_6 (6.06) respectively. Scores indicated that treatment T_4 was liked very much while treatments T_1, T_2, T_3 and T_5 and T_6 were moderately liked by the sensory panel.

Table 1. Ratio of Different Ingredients used in Herbal Tea Bags for standardization

Treatments	*Adhatoda vasica* (g)	*Tinospora cordifolia* (g)	Cardamom (g)	Ginger (g)	Basil (g)
T_1	0.25	1.50	0.10	0.30	0.35
T_2	0.50	1.25	0.10	0.30	0.35
T_3	0.75	1	0.10	0.30	0.35
T_4	1	0.75	0.10	0.30	0.35
T_5	1.25	0.50	0.10	0.30	0.35
T_6	1.50	0.25	0.10	0.30	0.35

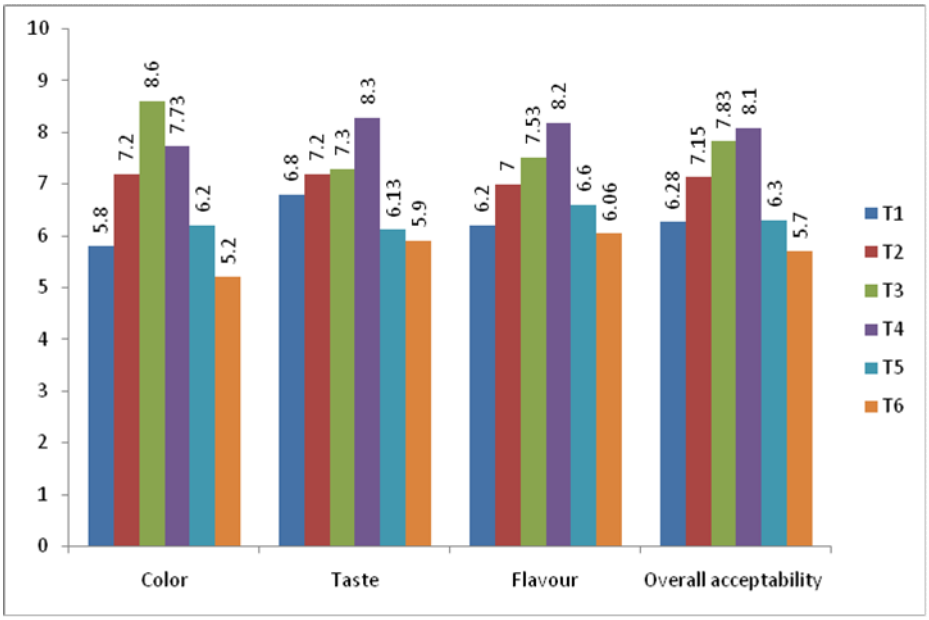

Figure 1. Average Sensory score of Herbal Tea Bags

Simon *et al.,* (2015) done a study to find out the effect of preferred spices on acceptability of consumer of spiced purple tea. Ginger was used as one of the ingredient other than cinnamon, nutmeg and lemongrass. Result revealed that on addition, ginger had a mean value of 5.56, 5.75, 5.93 and 6.99 for blending at 0%, 25%, 50% and 75% respectively. Overall acceptability had a mean score of 5.7. Results regarding taste revealed that T_4 (8.30) had the highest score followed by T_3 (7.3), T_2 (7.2), T_5 (6.13), T_1 (6.8) and T_6 (5.9) respectively. Scores indicated that treatment T_4 was liked very much while treatments T_1, T_2, T_3, T_5 and T_6 were moderately liked by the sensory panel. Alakali *et al.,* (2016) done the quality evaluation of herbal tea blends from ginger and Pavetta crassipes and found that sample C having ratio of 60/40(ginger/pavetta) was accepted on the basis of sensory analysis. Results regarding overall acceptability revealed that T_4 (8.1) had the highest score followed by T_3 (7.83), T_2 (7.15), T_5 (6.3), T_1 (6.28) and T_6 (5.7) respectively. Scores indicated that treatment T_4 was liked very much while treatments T_1, T_2, T_3, T_5 andT_6 were moderately liked by the sensory panel. Formulation of green herbal tea was done by Namdev and Gupta (2015) using Giloy leaves, Withania somnifera stems, Terminalia arjuna bark and Cinnamon bark. In another research done by Sarkar *et al.,* (2017) Adusa leaves was taken to make herbal tea as an expectorant for the treatment of asthma.

Nutritional Composition of Herbal Tea Bags: On the basis of sensory evaluation best treatment of developed Herbal Tea Bags were subjected to routine nutrient analysis using the standard procedures and the values are presented in table 2.

Table 2. Nutritional Composition of Developed Herbal Tea Bags

Nutrients	Herbal Tea Bags / 100g
Moisture (%)	7.61
Ash (%)	9.07
Protein (g)	14.85
Crude Fat (g)	0.91
Crude Fibre (g)	8.16
Carbohydrate (g)	59.4
Energy (Kcal)	305.19
Iron (mg)	22.03
Calcium (mg)	73.30
Vitamin C (mg)	59.20

Table 2 shows the nutritional composition of Tea Bags depicting the Moisture content 7.61%, Protein content 14.85g, Crude Fat 0.91g, Crude Fibre 8.16g, Ash 9.07g, Carbohydrate 59.4g, Energy 305.19 kcal, Iron 22.03g, Calcium 73.30g and Vitamin C 59.20mg. Moisture content affects the food products stability and storage, etc. The moisture content value for tisanes should be less than 11% (Kirk and Sawyer, 1997). If the value is above the prescribed limit, the tea formulation will be liable to mould infestation. As the value is below the prescribed level, the shelf life of the product is unaffected by the moisture content. Moisture content of the herbal tea was found to be 7.61%. Ash content analysis is another important parameter, because it also directly influences the stability, nutritional content of the food and its storage, etc. Ash represents the inorganic residue that remains when the water and organic matter is removed by heating, which indicates the measure of the total amount of minerals present in a food. Ash content estimation for Tea Bags was 9.07 %. The ash content value for tisanes should be between in the range of 4% to 14%. The protein content was determined by micro Kjeldahl method. The protein contents of herbal tea were shown in Table 2. The crude fiber of foods depresses the digestibility of other organic nutrients. The fibrous constituents of plant foods are found in the cell walls, enclosing the available nutrients. In this study, the fiber content was determined by acid-base treatment. The results were obtained by the standard comparison method. The fiber content of herbal tea was found 8.16g /100g. Crude Fat is also necessary though it is not major constituents in a tea brew but they can play an important role in the development of aroma and has an impact on nutritional profile of tea. The highest amount of Fat contents in fermented tea may be during processing. These results are in line with previous study of Rehman *et al.,* (2002) who suggested 0.95-1.62% fat content for better quality of the commercial tea samples. The crude fat content of herbal tea bags was found to be 0.91g/100g and was shown in Table 2. Total carbohydrate content of foods has been calculated by difference rather than analyzed directly. Under this approach, the other constituents in the food (protein, fat, water, alcohol, ash) are determined individually, summed and subtracted from the total weight of the food. This is referred to as total carbohydrate by difference and is calculated by the formula:

100 - (Weight in grams [protein + fat + water + ash + alcohol] in 100 g of food).

It should be clear that carbohydrate estimated in this fashion includes fiber, as well as some components that are not strictly speaking carbohydrate, e.g. organic acids. Total carbohydrate can also be calculated from the sum of the weights of individual carbohydrates and fiber after each has been directly analyzed. The data were shown in Table 2. Dehydrated leaves of Adhatoda vasica and Tinospora cordifolia are rich in Energy, Carbohydrate and Calcium and so the formulated product is also rich in the same nutrients. Although presence of other ingredients, cardamom, basil and ginger also enhances the nutrient percentage but since they are present in negligible amount so there contribution might be less.

Anti-Nutritional Composition of Developed Herbal Tea Bags: On the basis of sensory evaluation best treatment of developed Herbal Tea Bags were subjected to anti-nutrient analysis using the standard procedures and the values are presented in table 3.

Table 3. Anti-Nutritional Composition of Developed Herbal Tea Bags

Parameters	Herbal Tea Bags (per 100 g)
Tannin (g)	0.004
Phytate (mg GAE)	85.93

Table 3 shows the anti nutritional composition of Herbal Tea Bags which includes tannin and phytate. Tannin in Herbal Tea Bags was found to be 0.004g while phytate was 785.93g. The results are in agreement with the study done by Jyotismita *et al.,* (2015) which have found that elevated level of tannin decrease feed intake, effect growth rate, feed efficiency and digestibility of protein. Tannin binds dietary iron that prevents the absorption of non heme iron. Hence, the study states to have lesser content of tannin in tea. Phytate content is low in tea result coincides with the study done by Clemens (2014) which states that consumption of Phytate in large quantity also hinders the bioavailability of minerals such as iron and continuous consumption of excess tannin and phytate disturb the metabolism of body.

Antioxidant Composition of Developed Herbal Tea Bags: On the basis of sensory evaluation best treatment of developed Herbal Tea Bags were subjected to antioxidant analysis using the standard procedures and the values are presented in table 4.

Table 4. Antioxidant Composition of Developed Herbal Tea Bags

Parameters	Herbal Tea Bags (per 100 g)
Total Phenolic Content (mg)	0.177
Total Flavanoids Content (mg QE/g)	12.98
Percent Radical Scavenging Activity (%)	85.77

Table 4 depicts the anti-oxidant composition of Herbal Tea Bags having 0.177mg of Total phenolics content, 1.98mg QE total flavanoid content and Percent Radical Scavenging Activity was 85.77%. Phenolics and Flavonoids are a wide class of chemical compounds found in plants. They impart quality and nutritional value and plays a vital role in human fitness such as anti-inflammatory (Lee *et al.,* 1993), antidiabetic (Vessel *et al.,* 2003), antiviral (Cody *et al.,* 1986), antioxidant (Ghasemzadeh and Jaafar 2011). Therefore, total phenolic and flavonoid content of different methanolic extracts of herbs were estimated Table 4. DPPH method is most commonly used for screening of antioxidant activity of many herbal plants. DPPH is a stable free radical with violet colour. If free radicals have been

scavenged, DPPH will change its colour from violet to pale yellow or colourless. This property allows visual monitoring at 517 nm. A scavenging activity in % inhibition is given in Table 6. Antioxidants are working as a protection of cells against the destructive effects of reactive oxygen species (super oxide or hydroxyl radicals). The reaction between antioxidants and reactive oxygen species results in oxidative stress causes cellular damage (Siddique and Alim, 1997). Oxidative stresses have been related to cancer, aging, atherosclerosis, inflammation, ischemic injury and Neuro degenerative diseases (Sofowora, 2011). Nearly similar result was obtained by the study conducted by Namdev and Gupta (2015) where percent radical scavenging activity of herbal tea made of various ingredients including Tinospora cordifolia leaves was 93.29%. Gabriel and Nkemakonam (2015) prepared herbal tea from *Moringa oleifera* dehydrated leaf which shows almost similar amount of flavoids content (16.50) as the result of this study shows 12.98.

Summary and Conclusion: Increasing awareness about herbal medicinal plants attracts people to take herbal preparation to combat disease. The use of herbal preparations and phytonutrients or nutraceuticals continues to expand rapidly across the world with many people now resorting to these products for treatment of various health challenges in different national healthcare settings. Two such plants are Adhatoda vasica (Adusa) and Tinospora cordifolia (Giloy) that possess antidiabetic compounds (vasicine and vascinol in Adusa and Berberine in Giloy) which aids in lowering the elevated blood glucose level. Using the extracts of these medicinal plants in various forms like infusion, decoction, strong decoction, tinctures, syrups and maceration etc. are commonly used since ancient time for medicinal effects. Incorporation of leaves of Adusa and Giloy as food products enhanced the nutritive value of traditional recipes by improving their micronutrient content as well as active compounds present in both herbs aids in lowering the high blood glucose level.

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