Herbal tea formulation using different flavoured herbs with dried Corn Silk powder and its sensory and phytochemical analysis

ABSTRACT

The potential applications of corn silk are closely related to its phytochemical composition and its bioactive compounds such as flavonoids and phenolics which have beneficial effects on human health. Corn silk is considered as a waste during corn processing. Being healthy and nutrient dense waste, corn silk can be used for formulation of health food product which on one hand will improve the nutrient quotient of individuals and on other add on to the livelihood security of the farmers. Several underutilized plants material and herbs exist with potential for processing into herbal tea, research in product development of herb teas is limited. So this study was conducted to use dried corn silk powder variety of VL Baby corn-1 for formulation of flavoured herbal tea with different combination of nutmug (*Trachyspermum ammi*), Clove (*Syzygium Aromaticum*), Cinnamon powder (*Cinnamomum verum*),Timur (*Zanthoxylum alatum)*, Tulsi (*Ocimum tenuiflorum*), *Gandraini, Cymbopogon citratus* (Lemon grass), Blend(Clove+Timur+Gandhredhi), and one without any combination only corn silk. Result of sensory evaluation indicated that the mean scores of all eight flavoured herbal corn silk tea along with only corn silk tea (control) showed acceptable in terms of all sensory parameters and the maximum scores fell in category of 'liked moderately'.

Keyword: Herbal, tea, corn silk, sensory, antioxidants.

1. INTRODUCTION

The drinking of tea begun in China centuries ago, and has over the years become an inseparable part of most cultures worldwide. Tea is currently the most widely consumed beverage in the world (**Schmidt *et al.,* 2005**) and therefore ranks as an important world food product. Tea is generally consumed for its attractive aroma and taste as well as the unique place it holds in the culture of many societies. In recent times, there is renewed interest in tea because of growing consumer awareness of health benefits derived from tea consumption (**Mckay and Blumberg, 2002**).

By definition, tea is an infusion of the leaves or other parts of the evergreen tea plant (*Camellia sp*). In recent times, however, a fourth category, called herb teas, is gaining increasing popularity among consumers. Unlike traditional teas, herb teas are prepared from plants other than *Camellia* (**Bender, 2003**).

Tea preparation follows a simple procedure. Hot water (70 °C to 100 °C) is poured over the plant part(s) in a container and allowed to steep for a few minutes (usually 1 – 5 min) after which the plant material, usually contained in a bag, is removed from the container. The temperature of the water used and the duration of steeping affect the 'strength' of the tea. Tea is drunk hot, warm or iced. In some cases milk and/or a sweetener such as honey or sucrose may be added before drinking (**Hakim *et al.,* 2000**).

According to **Abbey and Timpo (1990)**, indigenous herbs are in general heavily under-exploited in spite of their huge dietary potential. It is therefore imperative to explore the potential of indigenous plant materials in the development of new herb teas. Eight examples of indigenous plant materials, herbs and spices discussed in this paper are Ajwain (*Trachyspermum ammi*), Clove (*Syzygium Aromaticum*), Cinnamon powder (*Cinnamomum verum*),Timur (*Zanthoxylum alatum)*, Tulshi (*Ocimum tenuiflorum*), *Gandraini* and *Cymbopogon citratus* (Lemon grass) with combination of dried corn silk powder variety of VL Baby corn-1.

Lemon grass has been a preferred component of many cuisines for centuries because of its excellent aromatic properties. Infusion of lemon grass leaf gives an aromatic drink with a characteristic lemon flavour (**Figueirinha *et al.,* 2008**).

Cloves action also reported as analgesic property, anesthetic action, antibacterial property, antiparasitic action, antidotal property, antioxidant action, antiperspirant action, antiseptic property, carminative action, deodorant, digestive disorders, rubefacient action, stimulant property, stomachic action (**Bhat and Vivek, 2009; Delaquis *et al.,* 2002**).

cinnamon spice is regarded as antipyretic, lowering in body temperature, antiseptic, astringent, inflammatory problem, carminative, diaphoretic, fungicidal, stimulant, and stomachic (**Khan *et al.,* 2013).**

Corn silk has been found to be nontoxic and is safe for human consumption. In Asia, it is used in tea as a healthy and medical drink. Corn silk powder can also be used as food additive and flavoring agent as it does not change the taste. Corn silk tea has been claimed to have many benefits to human health such as decreasing inflammation, reducing edema (accumulation of

water in body), improving obesity, and lowering BP. Corn silk tea has the advantages of good taste, low price, and good availability. For these reasons, treating hypertension with corn silk as an adjuvant phytotherapy is easy to implement and the patients with hypertension are likely to have better compliance. Urinary tract infections and kidney stones can be improved with the aid of corn silk tea. The diuretic properties of corn silk, which, when used as tea, soothes irritation in the urinary tract system, has increased its medicinal importance. In spite of various pharmacological activities, corn silk is still considered as a waste during corn processing

Being healthy and nutrient dense waste, corn silk can be used for formulation of nutritious health food product which will on one hand improve the nutrient quotient of individuals and add on to the livelihood security of the farmers on the other hand. So use of corn silk may provide additional income to farmers and corn silk may provide additional health benefits to population as well as increase diet diversity of population.

The wastage of the corn silk in food service industry can cause negative impact to the environment. Apart from benefits of its flesh, corn silk also contains nutrients. Thus, the study been conducted to overcome the problem of wastage corn silk, we suggest to make drink from corn silk. Hence there is a need to increase the nutrients consumption to deal with many health risks and also there is great opportunity to enhance the market with the different choices of flavored herbal tea with good nutritional content. So main objective of this study was to explore alternative uses of above mentioned herbs spices as flavouring agent by blending with corn silk to produce different flavoured herbal tea with acceptable sensory properties and their phytochemical analysis.

RESEARCH JUSTIFICATION

Developing new flavoured herbal tea from indigenous corn silk will provide novel uses for waste materials. It will further provide consumers with new alternatives to traditional teas. Moreover the research will bring to light the potential of the corn silk a waste material for food product development. The research will broaden understanding of the sensory characteristics and preferences of herb teas in particular and beverages in general. It will further advance research in herb tea product development.

2. MATERIALS AND METHODS

2.1 SAMPLE COLLECTION

Corn silk (female inflorescences) variety of VL Baby corn-1 was collected from from NEB CRC, G.B.P.U.A.T. Pantnagar, Uttarakhand, India. Lemon grass and Tulshi leaves were, collected from MRDC (Medicinal Plants Research and Development Centre), Pantnagar and **o**ther spices which were used for different flavor in corn silk tea purchased from local market. Empty filter tea bags were purchased from online stores.

2.2 SAMPLE PREPARATION AND STORAGE

2.2.1 Pre- treatment of corn silk

The corn silk collected in cleaned paper bag and bring it land to lab for processing. In lab corn silk was washed in 0.1% concentration of salt solution to remove foreign matter and salt added water eliminates the fishy flavor of corn itself. The washed corn silk sprayed on a clean surface than after 10 minute cut into a proper size.

2.2.2 Processing of corn silk to obtain powder

At same day or second day washed corn silk was dried in tray drier for 6 hours at 40oc resulting final moisture content of 7-10%. Dried corn silks was crushed manually and grind it in an electric grinder then sieving through sieve size 22 mesh used for tea Dried corn silk powder was stored in air tight container at room temperature.

2.2.3 Processing of other flavoring materials

All plant materials were carefully inspected and all foreign materials removed. Lemon grass and Tulshi leaves were tgently rinsed in tap water, cut into about three cm pieces using a stainless steel kitchen knife and spread thinly on paper and dried in a trey drier for 5 hours at 40 °C. After drying the samples were milled using an electric grinder present in department. Milling was performed for about 15 min. Other spices Ajwain, Clove, Cinnamon, Timur and *Gandraini also* milled in same grinder**.** The blender was washed before and after milling of each sample. The milled material was sieved through an Aluminum sieve (2mm). Part of the sieved samples were stored in glass bottles with tight lids and labeled. Each tea bag contained approximately 5-6 g of product.

2.2.4 Preparation of Formulations

The eight dried and milled ingredients were mixed in dried corn silk powder in varying proportions and control was made with only dried corn silk powder to obtain nine different formulations (Table 1).Two gram samples of each formulation were bagged in rectangular infusion tea bags (5cm × 4cm). All bagged samples were stored in glass jars at between 28 °C and 34 °C away from sunlight. They were labeled accordingly for sensory and phytochemical analyses.

Table no.1: Main and flavoring ingredients used in preparation of Flavored Herbal Corn Silk Tea

Product code	**Main Ingredients/ quantity**	**Flavored Ingredients**	**Quantity**
A (control)	Dried corn silk powder 5 g		
B	Dried corn silk powder 5 g	Ajwain	100mg
C	Dried corn silk powder 5 g	Clove powder	50mg
D	Dried corn silk powder 5 g	Dried lemon grass powder	20mg
E	Dried corn silk powder 5 g	Cinnamon powder	10mg
F	Dried corn silk powder 5 g	Timur powder	2mg
G	Dried corn silk powder 5 g	Dried Tulshi powder	100mg
H	Dried corn silk powder 5 g	Gandraini	30mg
I ((blend)	Dried corn silk powder 5 g	Clove, Timur, Gandraini	20mg, 1mg, 20mg

2.3 SENSORY EVALUATION

In yet another embodiment of the present study, the different nine flavoured herbal tea with varying combination of ingredients have sensory qualities as mentioned in Table 1. For consumer acceptability of different nine flavoured herbal tea bags were evaluated by 50

consumer by using 9 point hedonic scale. It was done in the different department, collages and hostels, G.B.P.U.A&T Pantnagar, Uttrakhand (different segments of population). Flavoured Herbal tea were evaluated for sensory qualities viz., colour, aroma, flavor, aftertaste, astringency and overall acceptability using nine point Hedonic Scale **Amerine *et al* (1965)** by a panel of 50 consumers of university campus. The panelists were instructed to score their acceptance for 6 attributes of the infusions: colour, aroma, flavor, aftertaste, astringency and overall acceptability. Where a panelist did not clearly understand the meaning of a particular attribute, explanation was provided.

2.3.1 Preparation of Infusions

Infusions were prepared from all bagged samples including the control. Bags of each sample formulation were placed in a cup and water (100 ml) was poured into the cup (Figure 1). Mineral water was used. The formulations were allowed to infuse for 5 min. The bags were then removed from the infusions. The infusions were unsweetened. 50 ml Fresh infusion were used for sensory evaluation and 50 ml of each tea bagged infusion kept in refrigerator at -20^{0}c for phytochemical analysis .

Figure 1. Preparation of infusion

2.3.2 Procedure for serving tea to panelists

Sample infusions were alphabetically coded and served randomly to panelists. About 30 ml of each infusion was served in a 50 ml transparent cup. One sample was served at a time. Panelists were free to analyze the samples in any order of their choice. Panelists were discouraged from conferring among one another during the analyses. To minimize possible carry-over effects, panelists were required to rinse their mouths thoroughly with warm water after each tasting and wait 90 s before tasting the next sample. Panelists were not required to swallow all 30 ml of each

sample; however they were asked to hold about 10 ml sample in the mouth for 5 s and swallow small quantities in order to appreciate the full sensory character of the beverage. Panelists were allowed to repeat tasting where necessary.

2.4 PHYTOCHEMICAL EVALUATION

For phytochemical analysis Infusions of all developed flavored herbal tea were used accordingly in triplicates .The total phenol content was determined according to method given by **Singleton and Rossi, (1999)** using Folin-ciocalteu reagent. Total flavonoid content was determined according to method given by **Zhishen *et al.* (1999).** The total antioxidant capacity was determined according to method given by **Williams *et al.* (1995)** using 1,1-diphenyl-2-picryl hydrazyl (DPPH) and total Antioxidant activity was analyzed also method given BY **Williams *et al., (*1995).**

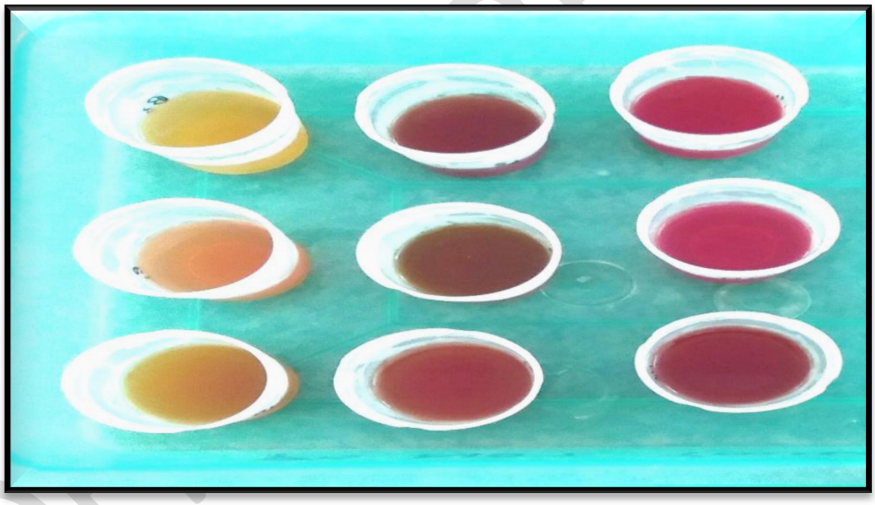

Figure 2. Prepared infusion of all 9 herbal tea

2.5 STATISTICAL ANALYSIS

Sensory parameter as well as the phytochemical constituent analysis was fitted to one way analysis of variance (ANOVA) and critical difference using the OPSTAT software method **(Sheoran *et al.*, 1999).** For phytochemical analysis values were calculated per 100 ml of flavored herbal tea powder. Where variations were observed among the samples at 5% statistical significance.

3. RESULTS AND DISCUSSION

3.1 Sensory Evaluation

Consumer acceptability is an important issue for guiding the development of herbal-based teas that fit market demand. Results presented in Table 2 and Fig.3 indicated that the mean scores of all eight flavoured herbal corn silk tea along with only corn silk tea (control) showed acceptable in terms of all sensory parameters viz., colour, aroma, flavor, aftertaste, astringency and overall acceptability. Among all eight different flavoured herbal tea Lemon grass blend with corn silk were received highest sensory scores in terms of all parameter due to high concentration of aromatic oils in Lemon grass (**Baratta *et al.,* 1998; Kasali *et al.,* 2001**), it was expected that samples with higher proportions of Lemon grass would record higher mean scores followed by Cinnamon and clove blends. Addition of flavor and aroma into tea could given by simplisias addition such as orange peel, apple, cinnamon, lemongrass, ginger, clove, etc (**Anggraini, 2017**) Cinnamon commonly used as flavor and aroma enhancer in drinks such as tea, coffee and cacao (**Ferry, 2013**). **Qin *et al.,* (2010**) mentioned that eugenol and cinnamaldehyde compound that contained in cinnamon give distinctive fragrance and taste. Whereas corn silk tea (control) had lowest sensory scores followed by *Gandraini* and *Tulshi* blends. In our study we also found after blending with different spices in control corn silk tea showed increase in sensory parameter as compared with only corn silk tea similar result found in the study of **Ochanda et al., 2015** they indicated spices increased consumer preference of the aerated tea, and spices were preferred more than others as shown by the three best rated spice-tea mixes, including cinnamon at 10%, lemongrass at 5% and ginger at 15%, which had mean scores of 6.74, 6.35 and 6.58 respectively on a hedonic scale. From our findings it was observed that all types of tea were acceptable in terms of all sensory characteristics and the maximum scores fell in category of 'liked moderately'. Sensory evaluation of the herbal infusion in the study of **Kabilan *et al.,* 2019** was performed and showed herbal tea eligible for a commercial consumable with high scores from evaluators for its colour and aroma.

Table 2: Mean scores of sensory characteristics of Flavoured Herbal Corn Silk Tea

Tea	Sensory Characteristics

Codes	Colour	Aroma	Flavour	Astringency	After Taste	Overall acceptability
	Scores					
A(CS)	7.94±0.84	7.78±0.85	7.00±1.17	7.09±1.23	6.80±1.36	7.24±1.14
B (CS:Ajwain)	8.03±088	8.03±0.87	7.55±0.85	7.48±0.97	7.52±1.10	7.63±0.87
C (CS:Clove)	8.06±0.75	7.92±.84	7.88±0.93	7.72±0.95	7.79±1.06	7.88±0.88
D (CS:Dried Lemon grass)	7.95±1.17	8.03±0.91	7.99±0.95	8.03±0.93	8.06±1.04	7.92±0.94
E (CS:Cinnamon	8.00±0.80	7.88±1.04	7.60±1.18	7.66±1.20	7.57±1.30	7.64±1.31
F (CS:Timur)	7.92±0.78	7.94±0.75	7.28±0.99	8.03±0.95	7.40±1.21	7.43±1.04
G (CS:Tulshi)	7.84±0.84	7.91±0.91	7.44±1.21	7.53±1.31	7.42±1.33	7.64±1.11
H CS:Gandraini)	7.63±0.95	7.78±1.01	7.30±1.20	7.33±1.21	7.31±1.32	7.47±1.14
I(CS:Clove+Timu + Gandraini)	7.92±0.94	7.65±0.87	7.36±1.21	7.39±1.23	7.40±1.11	7.46±1.04

Values are mean ± SE of fifty observations.

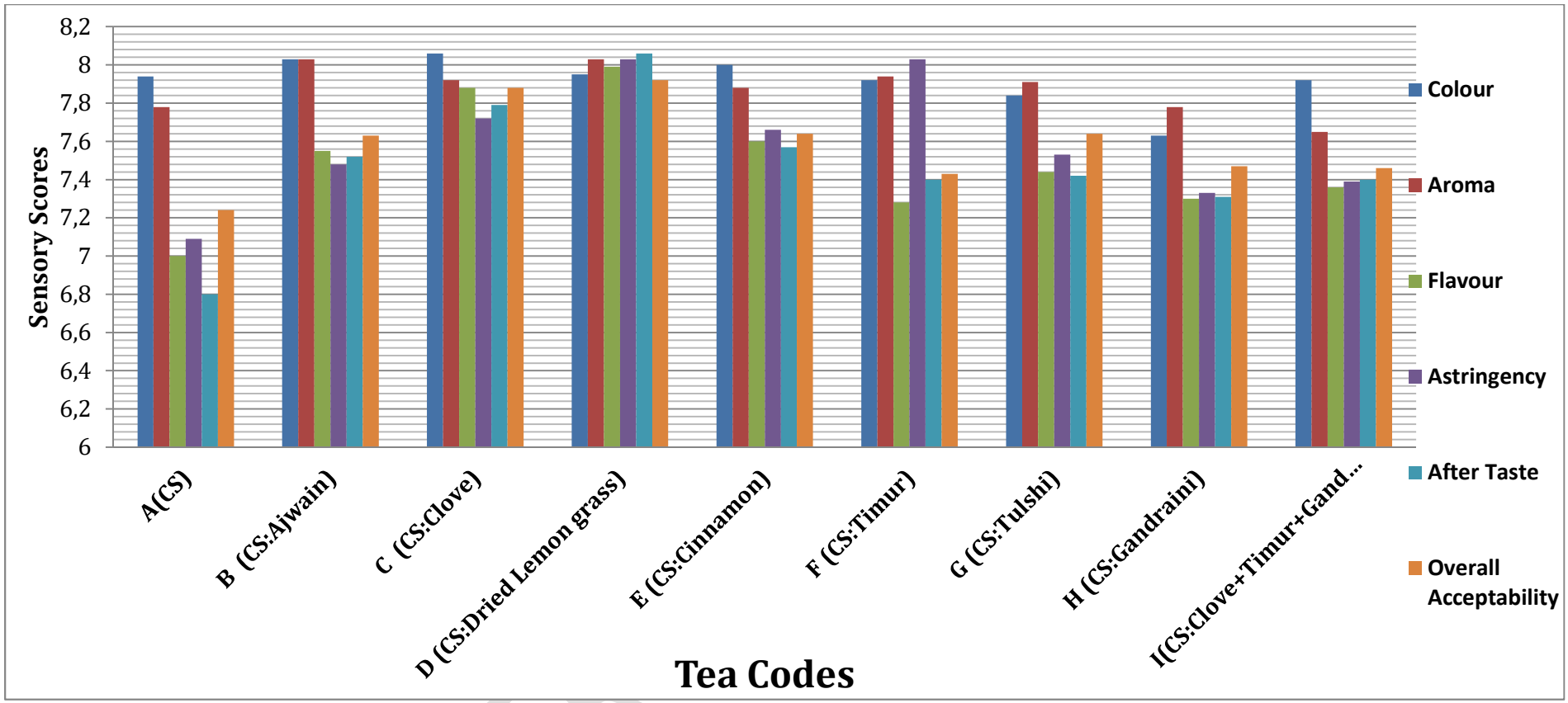

Figure 3 : Mean scores of sensory characteristics of Flavoured Herbal Corn Silk Tea

Because of reports of high concentra-tion of aromatic oils in Lemon grass (**Baratta *et al.*, 1998; Kasali *et al.*, 2001**), it was expected that samples with higher proportions of Lemon grass would record higher mean scores for aroma. Even though most of the scores followed this trend, there were few exceptions

3.2. Phytochemical analysis

Phenolics and Flavonoids are a wide class of chemical compounds found in plant based materials. They impart quality and nutritional value and plays a vital role in human fitness such as anti-inflammatory, antidibatic, antiviral antioxidant Therefore, total phenolic, flavonoid and antioxidant activity of different aqueous extracts of different flavoured herbal were estimated in Table 3.

3.2.1 Total phenolic content (mg GAE/100 g)

The polyphenol content of ingredients in herb tea formulation is important because it gives a direct indication of the health-enhancing property of the herb. In this study result of total phenolic content of corn silk tea (aqueous extract of corn silk) was showed 269.823±0.70 mg GAE/100g which was approximately near to value given by **Nurhanan *et al.*, 2012** they showed the methanolic extract was estimated to contain 272.81 mg GAE/100 g dry plant while the water extract contained 256.36 mg GAE/100 mg dry plant. The total polyphenol content of the corn silk extract in our study was found to be lower than the corn silk extracts reported by other researchers (**Ebrahimzadeh *et al.*, 2008; Maksimovic *et al.*, 2005**). Total phenolic contents in corn silk were ranging from 80.8 to 117.1 μ g GAE/g (**Liu *et al.*, 2011**) which was lowest than our findings.

Other eight developed flavoured herbal tea also found flavonoid content in ranged between 210.853±0.70- 261.690±0.30 which were significantly different at 5% significance. **Das *et al.*, 2019** also reported Balck tea contained Polyphenol (256.47 ± 1.72mg GAE/cup of 100 ml tea) which was close agreement to our result. In among eight herbal tea different combinations with corn silk, Timur corn silk flavoured herbal tea was found significantly highest total phenolic content. All the values were significantly different ($P < 0.05$).

3.2.2 Total flavonoid content (mg RE/100g)

Infusion of corn silk tea contained 80.373±0.34 mg RE/100g which was highest in among all tea. Our finding were similar with study of **Liu *et al.,* 2011** stated that total flavonoid contents in corn silk were ranging from 30.1 to 88.8 µg RE/g respectively; this variation due to Corn varieties difference (**Sarepoua *et al.*, 2013).** However, these results were in agreement with that of **Haslina *et al.,* 2017**. However in different flavoured herbal corn silk the value of flavonoid content ranging between value 34±967±0.01- 78.520±0.05 (mg RE/100g) in all blends clove blends with corn silk got significantly highest flavonoid content and blends of three herbs (Clove, *Timur* and *Gandhredhi)* got lowest content. **Das *et al.,* 2019** blend herbal tea of black tea with clove 1:1 had flavonoid content **(**90.83 ± 0.97 mg CE/cup of 100 ml tea). In our findings all the values were significantly different ($P < 0.05$).

3.2.3 DPPH free radical scavenging activity (µg/ml)

Results on DPPH free radical scavenging activity indicated that corn silk tea had 81.215±0.75 µg/ml whereas blend with *Timur* had highest value 94.848±0.11 which was nearest to value of percentage inhibition of DPPH for green tea 92.3±0.02 (**Azli *et al.,* 2018**) and *Ajwain* blend had lowest value 64.201±0.40among all eight different blends with corn silk .The value of DPPH in study of **Das *et al.,* 2019** was much higher than our study with valye 432.36 ± 2.99 mg AAE/cup of 100 ml tea. The percentage of DPPH radical scavenged by corn silk extract was 92.6 at a concentration of 1.6 mg ml‑1. IC50 of the extract (**Khanahmadi *et al.,* 2010**).

3.2.4 Total Antioxidant Capacity (mg TE/ 100g)

The values for total antioxidant capacity were almost similar in all nine tea ranged from 2.271±0.02 to 3.419±0.04. Blends with Timur (*Zanthoxylum alatu*) in corn silk showed highest value and Clove,*Timur,Gandhredhi* blends got lowest value .Nowadays , it has been directed much attention towards the identification of plants antioxidant that can be used for human consumption .Corn silk was a byproduct of maize, it has been consumed traditionally as a medicine owing to its antioxidant properties, phytochemical ingredients and free radical scavenging activity **(Nurhanan and Wan Rosli, 2012 ; Vijitha and Saranya, 2017**).

Table. 3 Antioxidant activity of Flavored Herbal Corn Silk Tea extract of and its fractions.

Tea Codes	DPPH free radical scavenging activity(µg/ml)	Total Antioxidant Capacity (mg TE/ 100g)	Total flavonoid content (mg RE/100g)	Total phenolic content (mg GAE/100g)

A	81.215±0.75	3.319±0.01	80.373±0.34	269.823±0.70
B	64.201±0.40	2.938±0.30	68.907±0.04	216.0.42±1.51
C	68.948±0.04	3.185±0.02	78.520±0.05	234.880±1.94
D	83.948±0.10	3.419±0.04	50.657±1.09	257.230±0.35
E	79.837±0.05	3.328±0.01	43.747±0.05	222±0.02±0.68
F	94.848±0.11	3.409±0.30	38.077±0.10	261.690±0.30
G	80.232±0.44	3.338±0.01	42.313±1.00	210.853±0.70
H	81.791±0.35	3.310±0.01	76.380±0.07	239.710±1.07
I	77.513±0.34	2.271±0.02	34±967±0.01	222.267±0.19
CD at 5 %	1.099	0.039	1.532	2.984
SE(m)	0.36	0.013	0.512	0.99

Values are mean ± SE of three independent determinations

A=Only Corn Silk , B= Ajwain, C=Clove, D=Dried Lemon grass leaves, E=Cinnamon, F= Timur (*Zanthoxylum alatu*), G=Tulshi, H= Gandhredhi I= Blend(Clove+Timur+Gandhredhi)

4. CONCLUSION

The results of this research have provided an insight into the differences in both phytochemical properties like antioxidants and consumer preference in aromatized corn silk herbal tea infusions blends with different herbs, spices and medicinal plant materials, which have not been studied before. These teas are popular owing to their fragrance as well as their antioxidant properties. The popularity of tea is increasing globally because of its role as a significant source of phenolic compounds in the human diet. From this study it is concluded that corn silk powder was obtained which was standardized and evaluated for preparation of herbal tea. Corn silk has rich in antioxidants hence they can be used in order to improve the health of human being because free radicals are the major cause of different disorders. Hence by using the Corn silk herbal tea can be prepared. This preparation can be used in dry or liquid form to improve human health. The taste of this herbal bend can be possible with FDA approved natural ingredients for better compliance and can be served with or without sugar. Further study is necessary to make combinations of specific herbs for treatment of different types of diseases

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