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Phytonutrient exploration and formulation study in medicinal herb- *Cymbopogon citratus*

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Abstract
Cymbopogon citratus, (lemongrass) is a widely used medicinal herb in tropical countries, especially in Southeast Asia. The essential oil of the plant is used in aromatherapy. The compounds identified in *Cymbopogon citratus* are mostly terpenes, alcohols, ketones, aldehydes and esters. Lemongrass is often taken orally, applied directly to the skin, or inhaled as aromatherapy for many different ailments. Vitamin A and natural citric acids are also made from lemongrass. Lemongrass can help prevent the growth of certain bacteria and yeasts. Lemongrass also contains substances that are believed to relieve pain and swelling, reduce fever, improve blood sugar and cholesterol, stimulate the uterus and menstrual cycle, and have antioxidant properties. Cholesterol is a lipid found in the body that aids in digestion and is necessary for the formation of hormones. Lemongrass has many different pharmacological uses. It is a medicinal plant, the compounds of which can repel pathogens and increase the resistance of the herb to pathogenic diseases. Lemongrass is widely used in herbal teas and other non-alcoholic beverages, baked goods and sweets. People have used lemongrass in traditional medicine to relieve pain, stomach problems and fever. In this study, a phytochemical, nutritional and compositional study of the medically important *C. citratus* was carried out, the results of which showed higher concentrations of carbohydrates and alkaloids (+++) tannins (+=), pentoses and saponins (+). Nutritional analysis showed a higher concentration of available nutrients, representing the good nutritional value of *C. citrate*. 20 panelists analyzed the sensory parameters of tea, Jalebi and marmalade such as appearance, taste, texture, flavor, color and overall acceptability. The products were compared to standard products and were very well received by the panellists.

Keywords: Medicinal herb, *Cymbopogon citratus*, medicinal plant

Introduction
Cymbopogon citratus is a genus of approximately 55 species distributed in tropical and subtropical regions of Asia and cultivated in South and Central America, Africa and other tropical countries. (Weiss,1997) [1] Cymbopogon is derived from the Greek words "kymbe" (boat) and "pogon" (beard), referring to the arrangement of the flower tips. (Dwivedi and Kukreja *et al.*, 2000) [2]. *Cymbopogon citratus*, Stapf (lemon grass) is often used in teas, soups and curries. It is also suitable for poultry, fish and seafood. These aromatic herbs are of great commercial interest because they can be widely used in various fields such as the food, pharmaceutical and cosmetic industries. The plants are propagated by seeds and slip and have thin and lanceolate leaves that emerge directly from the soil without a stem (Shah and Shri *et al.*, 2001) [48]. Although the cultivation of *C. citratus* is cosmopolitan, India has a monopoly on its production and export (Mukarram M., Khan M.M.A. *et al*., 2021) [6]. Considering the growing consumer demand and global market for essential oils, few recent reports have proposed various sustainable approaches to further increase lemongrass production either in the field or under cultivation using elicitors, nanoparticles and metabolite regulators (Uddin and Corpas 2021). Lemongrass has many therapeutic and medicinal uses and is widely used as a medicinal plant in many countries. This plant is full of citrus flavor and can be dried, powdered or used fresh. Lemongrass whole plant or essential oil is often used in herbal teas, broths, soups, fish, seafood and curries. Plant foods are essential sources of two types of polyphenols and phenolic compounds (Bashmil, and Cottrell, J.J. 2021) [24]. *C. citratus* is a potentially useful source of antioxidants when processed under optimal conditions. In addition, these leaves are a rich source of several bioactive substances, including alkaloids, flavonoids, terpenoids, saponins, phenols and tannins, which give lemon grass, leaves their characteristic flavor (Desobgo, and Jong *et al.*, 2021) [9]. Although the concept of antioxidants is mainly used to explain the therapeutic potential of phenolic and polyphenolic components, the use of phenolic compounds improves the potential of antioxidants that can act as reducing agents because they are useful in removing chelating prooxidants, free radicals and metal ions (Mukarram and Khan M *et al.*, 2000). *C. citratus* has antiphrasal properties and its essential oil is an excellent secondary treatment for those suffering from ulcers caused by *Helicobacter pylori* infection. The essential oil extracted from lemongrass is found mostly in the leaves of the plant, which is also an excellent source (Shah, Shri Panchal *et al.*, 2011) [48]. Taxonomic and botanical description Kingdom: Planned Distribution: Magnoliophyte Class: Liliopsida Family: Poaceae Genus: Cymbopogon Type: Citrates Medicinal plants are emerging as potential candidates in the cancer world and are raising hopes in the scientific community. Scientists are constantly searching for natural sources to find potential herbal medicines with tremendous anticancer properties (Sharma Mondhe, 2008). In this present work, Phytochemical and nutritional analysis was

performed to analyze the pharmacological nature of *C. citratus* and a compositional study was conducted to show the organoleptic nature of *C. citratus.*

Methodology

Materials and method

a. Collection of Plant sample

The sample used in the study was *Cymbopogon citratus* leaves. The leaves were collected from kanyakumarai district. The other ingredients were purchased from the nearby supermarket. The collected leaves were cleaned thoroughly and dried under the shade. Once the drying process was completed, the dried leaves were ground to powder using blender for use. The dried leaves were powdered and kept in an airtight container for further studies.

Fig 1

b. Processing of the sample

The leaf sample was thoroughly washed in running water 2-3 times. The samples were cleaned to remove the foreign particles. Then it was dried by shade with careful attention. The dried *Cymbopogon citratus* was powdered using a standard mixer, till it becomes a fine powder. Then the leaf sample powder was packed in polyethylene bags and stored in the refrigerator for further analysis.

b. Preliminary phytochemical analysis

The preliminary phytochemical analysis was carried out to reveal the presence of the phytochemicals like tannins, saponins, alkaloids, carbohydrates and pentoses. Ferric chloride test, Frothing Test, alkaloids, Barfoed's test, pentoses test were carried out in extracts of the selected *Cymbopogon citratus* leaves and were tested for the presence or absence of tannins, saponins, alkaloids, carbohydrate, pentoses according to the standard method.

Sensory Evaluation study of *C. citratus* leaf extract

The quality of the prepared products was assessed by the means of human sense of Organs are called as "Sensory Evaluation or Organoleptic Evaluation". This evaluation was a valuable tool in solving problems involving food acceptability. (Manoranjankalia, 2002). Sensory analysis was performed using 50 exclusives of trained pane lists throughout each test. A total of 4-6 trials were performed (Lemongrass Leaf powder). A randomized block design with the affective test was carried out to make data for preference liking (Meilgaard*et al.*, 2007; Figueirinha *et al.*, 2008)

The powdered *C. citratus* leaves were formulated and used for the preparation of tea, jalebi and jam.

Table 1: Ingredients used for Tea Preparation

S. No	Ingredients	Standard Tea	*C. citratus* leaves Tea
1	*Cymbopogon citratus* leaves Tea	*1g*	
2	Green tea leaves	1g	
3	Cardamon	2 pieces	2 pieces
4	Sugar	5g	5g

Table 2: Ingredients used for Jalebi

S. No	Ingredients	Standard Jalebi	*C. citratus* leaves Jalebi
1	*C. citratus* leaves extract		150ml
2	Gram Flour		30g
3	Sugar	15g	15g
4	1/2 cup ghee	1/2 cup	1/2 cup
5	green cardamom	1/2 teaspoon powdered	1/2 teaspoon powdered
6	4 drops rose essence	4 drops	4 drops

Table 3: Ingredients used for Jam

S.no	Ingredients	Standard jam	*C. citratus* leaves Jam
1	*C.citratus* leaves extract		150ml
2	Pineapple extract	100ml	
3	Corn flour	5g	5g
4	Sugar	15 g	15 g

Result and discussion

Preliminary phytochemical analysis

In the present study preliminary phytochemical analysis of methanolic extract of *C. citrates* leaf extract reported higher concentration of carbohydrate and alkaloids (+++), tannins (++) pentoses and saponins **(+)** according to the standard method.

Table 4: Phytochemicals present in the methanolic extract of *C. citratus*

Sample	Phytochemicals				
	carbohydrate	alkaloids	tannins	pentoses	saponins
Methanolic *C. citratus* extract	+++	+++	++	++	+

Nutrient content of the *Cymbopogon citrate* Leaf Powder extract

The quantity of nutrients (Carbohydrates, Vitamin A, Iron, Calcium and Protein) present in the *C. citrates* leaf powder extract was analyzed using various standard methods and the results revealed the presence of Carbohydrates (25.31 g), Proteins (1.82 g), Vitamin A (6 mg), Iron (8.17 mg) and Calcium (65 mg).

Table 5: Nutrient analysis of *Cymbopogon citrates* leaf powder extract

Nutrient	Values
Carbohydrates	25.31 g
Protein	1.82 g
Vitamin A	6 mg
Iron	8.17 mg
Calcium	65 mg

Sensory Evaluation of the products

The sensory parameters such as appearance, taste, texture, flavor, color and over all acceptability of the Tea, jalebi, jam was analyzed by 20 panel members. The products were

compared to the standards products and were highly accepted by the panel members. The mean score value of *C. citratus* tea powder, Jalebi, and Jam was represented in Table.6.

Table 6: Mean score for *Cymbopogon citratus* leaves powder tea, Jalebi and Jam

S. No	Sensory Parameters	CCPT – *C. citratus* product tea		CCPJ – *C. citratus* product Jalebi		CCPJ – *C. citratus* product Jam	
	Values	Mean±SD	SME	Mean±SD	SME	Mean±SD	SME
1	Appearance	4.9 ± 0.14	0.05	4.8 ± 0.25	0.02	4.9 ± 0.14	0.05
2	Texture	4.8 ± 0.19	0.05	4.8 ± 0.19	0.05	4.8 ± 0.19	0.05
3	Taste	4.8 ± 0.19	0.05	4.8 ± 0.19	0.05	4.8 ± 0.19	0.05
4	Flavor	4.8 ± 0.19	0.02	4.8 ± 0.25	0.05	4.8 ± 0.16	0.03
5	Color	4.8 ± 0.25	0.02	4.8 ± 0.19	0.05	4.8 ± 0.25	0.02
6	Overall acceptability	4.8 ± 0.13	0.02	4.8 ± 0.13	0.02	4.8 ± 0.13	0.02

Discussion

Cymbopogon citratus (leaf) contains 1 to 2 percent of dry matter essential oil, the chemical composition of which varies greatly depending on habitat, genetic diversity and agrotechnical treatment of the crop. The volatile oil from the root contains longifolen - (V4) (56.67%) and selina-6-en-4-ol (20.03%) (Ademuyiwa and Grace, 2015) [49]. The main chemical constituent of lemon essential oil is citral, while many other compounds such as neral, gerania, geraniol, β-myrcene, limonene, geranyl acetate, borneol, estragole, methyleugenol, citronellalal, pinenet, carenecole, methyleugenol, citronellalal, pineney, carenecole, methyleugenol, citronellalal, pineneol, carene-2, alcinoly, linetheticiny, alcinoly, linetheticin, β-Caryophyllene have also been reported (Carl Son *et al.,* 2001; Huynh, 2008 [47]; Shah *et al.,* 2011 [48]; Ademuyiwa and Grace, 2015) [49] Praveen Kumar *et al.* (2019) reported a preliminary phytochemical screening of ethyl acetate extract of lemongrass leaves followed by qualitative analysis by thin layer chromatography. Phytochemical analysis revealed several bioactive compounds such as flavonoids, phenols, tannins, alkaloids, etc. And TLC analysis further confirmed the presence of these secondary metabolites. Shendurse *et al.* (2021) observed flavonoids, tannins, saponins, steroids, terpenoids and coumarins in lemongrass essential oils. Annu Bhardwaj (2020) [45] represented the presence of secondary metabolites such as tannins, flavonoids, phenols, saponins, steroids, cardiac glycosides and alkaloids in a preliminary phytochemical analysis. In this study, phytochemical and nutritional analysis of the methanolic extract of *C. citratus* and showed phytochemicals *viz*. carbohydrates and alkaloids (+++), tannins (++), pentoses and saponins (+). A rough analysis shows the presence of nutrients in various amounts such as carbohydrates (25.31 g), protein (1.82 g), vitamin A (6 mg), iron (8.17 mg) and calcium (65 mg).

Carillon Salome Amarachi *et al*. (2012) prepared *C. citratus* leaf tablets prepared by wet granulation using acacia or gelatin as binder. The disintegration time of tablets prepared with acacia varied from 29.10 ± 0.13 to 208.00 ± 0.13 minutes for 2% and 8% tablets, respectively, and from 2.31 ± 0.27 minutes to 8.20 ± 0.24 minutes for 2% tablets and 8% tablets. Roheena Abdullah *et al.* (2023) prepared herbal tea using *C. citratus* leaves and sensory evaluation gave a good response from the respondents. In this research formula, *C. citratus* leaves in the preparation of tea, jam and jalebi gave good responses in sensory evaluation. All three formulations produced similar results in terms of overall acceptability.

Conclusions

This study focused on the phytochemical, nutritional and compositional studies of *Cymbopogon citratus*, as well as the composition of the product, recommending *C. citratus* for daily use with various foods. Due to its high amount of nutrients and phytochemicals, *C. citratus* can be used in the preparation of herbal medicines for various diseases and can be prepared and used with some foods. This study will help people increase their awareness of the nutrients and antioxidants rich in *C. citratus* leaf powder available in the local market and add food to food.

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