



## Formulation, Nutrient Analysis and Sensory Properties of Lemongrass (*Cymbopogon Citratus*) Incorporated Soup Varieties

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### ABSTRACT

**Introduction:** Lemongrass (*Cymbopogon citratus*) is a perennial and promising herb that has more than 500 species with a wide range of growth potentials and special functional qualities which make it more beneficial in many of the foods we consume every day. All parts of lemongrass including leaf, stalk, oil, and flavour are used since they contain the highest levels of nutrients and antioxidants.

**Objectives:** Formulation, analysis of nutrient content and evaluation of sensory qualities of lemon grass incorporated soup varieties.

**Materials and Method:** The raw ingredients were procured, processed, and prepared for three standard varieties of soup namely cabbage soup, radish soup and mushroom soup. Processed lemon grass paste was incorporated at the level of 5%, 10%, 15%, and 20% into three standard soups formulas. All the prepared variations were evaluated for sensory characteristics using a 5-points Likert scale and compared statistically. The most accepted soup variety was chosen for nutrient analysis and finally selected the best incorporation level of lemongrass paste.

**Results and Discussion:** The results stated that lemon grass incorporated radish soup had secured the highest significant overall mean rating score of 16.3 out of 20 when compared to the other two varieties of soups and was also selected as the best soup variation. The nutrient content such as energy, protein, fat, potassium and magnesium of selected lemongrass incorporated radish soups were comparable and 20% level of incorporation achieved maximum nutritional qualities.

**Conclusion:** The findings concluded that the prepared lemon grass incorporated soups were highly acceptable and received good scores in sensory evaluations. The lemongrass-incorporated radish soup was chosen as the best soup and also proved to have a good amount of nutrients. Hence, lemongrass showed high potential as a functional ingredient for soups.

**KEYWORDS:** Formulation, Incorporation, Lemongrass, Novel food, Nutrient analysis, Soups, Sensory evaluation.

### 1. INTRODUCTION

Lemongrass (*Cymbopogon Citratus*) is a tall, aromatic grass that is a member of the Graminaeae (Poaceae) family. *Cymbopogon* is a genus with roughly 55 different species. Their leaves, which emerge from rhizomatous root stock, can reach heights of 1.8 metres and a breadth of 1.2 metres (Bochare *et al.*, 2020). It is one of the most useful herbs for nutritional as well as functional component of foods. Botanically the word "herb" is used for "herbaceous plant". Herbs belong to the flowering or leafy green parts of plants that may be used as fresh or dried. Herbs and spices are traditionally defined as plants that are used for food, medicine, flavouring or fragrance purposes. However more recently herbs and spices have been identified as sources of various phytochemicals and minerals (Haque *et al.*, 2018). Lemongrass is grown in countries with tropical and subtropical climates, including Madagascar, India, Indonesia, and South America. It is grown in India's Western Ghats, Karnataka, Sikkim, Tamil Nadu, Arunachal Pradesh, and Karnataka. Kerala is one of the top exporters and producers (Srivastava *et al.*, 2013).

The term "lemongrass" derives from the unique lemony aroma of the essential oil present in the shoot. About 1000 t of lemongrass oil is produced from a 16000-ha area worldwide annually. It is cultivated on about 4000 acres in India and produces 250 t of lemongrass oil per year. The plant is extensively cultivated as living mulch along bunds and in marginal, waste, and underdeveloped areas. The plant's well defined ramified roots aid in the preservation of soil and water (Gawali and Meshram, 2019). Lemon oil is used extensively in the perfume industry directly and indirectly. It is widely utilised in household cleaners, mosquito



cream, soaps, detergents, agarbatti, and tea blending. Additionally, oil provides a starting material for certain significant isolates, like geraniol and citronellol, which can be transformed into some of the most popular aromatics. Oil includes  $\alpha$ -ionone, a precursor to vitamin B12 and an antibacterial and anti-flatulent substance. Cough syrup made with citronella oil helps to relieve muscle fatigue and promotes wound healing. The oil has both excellent medicinal and aroma therapeutic potentials (Ranade, 2004). Several bio active compounds can be found in lemongrass tea's decoction, infusion, and essential oil extracts. Antioxidant, anti-inflammatory, antibacterial, anti-obesity, antinociceptive, anxiolytic, and antihypertensive activities promote pharmaceutical claims (Olorunnisola *et al.*, 2012).

The study of natural substances as potential sources for health functions has recently attracted the attention of the pharmaceutical research community in especially because, if they satisfy regulatory and scientific testing criteria, they might potentially serve as frontier pharmaceuticals (Santoso *et al.*, 2018). Lemongrass has been utilised as a folk medicine throughout the world for a variety of conditions. Several biological activities, including antibacterial, antifungal, antiprotozoal, anti-inflammatory, antioxidant, and anti-carcinogenic characteristics, have been documented over time as a result of scientific research and claimed as a remedy in treating ringworm infestation, for nervous, gastrointestinal disturbances, fevers and hypertension (Silva and Bárbara, 2022). People in India tend to consume more functional foods and supplements on a daily basis as a result of growing dietary awareness and interest in the country as well as rising demand for healthy and functional foods (Mule *et al.*, 2018). Although functional activity is a significant factor in the application of a functional ingredient in food, it is also necessary to consider how the component will affect sensory characteristics and acceptance as well as how practical it will be to use in the food product. However, no studies have been done on the incorporation of lemongrass as a useful component in soup production. The aim of this article is to develop three potential lemon grass incorporated soup varieties, analyse the nutrient content, and evaluate the sensory qualities of the prepared lemon grass incorporated soups.

## 2. MATERIALS AND METHODS

### 2.1 Selection of ingredients

Lemon grass was chosen primarily for its abundance in phenolic and flavonoid components, which are potential sources of antioxidants. Tomatoes, radish, and mushroom were selected for their greater dietary sources while tomatoes, salt, and pepper were used as flavoring agents to boost the palatability of the soups.

### 2.2 Procurement and processing of selected ingredients

Raw ingredients were procured from the local market in Mannargudi city. The proposed study was carried out in the department of Nutrition and Dietetics, Sengamala Thayaar Educational Trust Women's College (Autonomous), Mannargudi, Tamilnadu. Lemon grasses were hand-washed thoroughly with tap water to get rid of the soil and lessen the number of microbes on the surface. The lemon grasses were then surface dried with a soft cloth and ground them in to fine paste using mixer grinder, stored in glass container until for soup formulation. Cabbage, mushroom, and radish were washed clearly after removing the outer layer. They were cut into small pieces. The other ingredients such as tomatoes, onion, ginger, garlic, salt and pepper were also purchased, processed and made ready for soup making process.

### 2.3 Formulation of lemon grass incorporated soup varieties

About three variations of lemon grass incorporated soups were developed and coded as lemon grass incorporated mushroom soup (LGMS), lemon grass incorporated radish soup (LGRS) and lemon grass incorporated cabbage soup (LGCS). The level of incorporation of lemon grass in to various soups is given in Table 1. The processed vegetables were tossed in separate soup bowls for each variation with a small amount of oil. About 150 ml of water was added along with measured paste of lemon grass, red chilies, garlic, onion, and ginger. They were boiled for fifteen minutes in low flame. Salt and pepper were added for taste. The control soup was also prepared by using the same procedure excluding lemon grass for better comparison of standard variations.

### 2.4 Organoleptic evaluation of lemon grass incorporated soups

Integrating human senses to evaluate appearance, flavour, colour, texture, and taste is a scientific method for evaluating sensory attributes (Anitha and Pa Raajeswari, 2021). Acceptability testing was done by 20 panel members for the developed soups using five points Likert scale with the highest score ranging from Excellent (5) to Poor (1). The panel members were instructed about the evaluation procedure and score ratings were obtained in the sensory evaluation sheet.



## 2.5 Evaluation of nutritional qualities of the health mix

Nutrients such as calories, protein, fat, ash, moisture, potassium and magnesium were analyzed using standard procedure.<sup>15</sup> Estimation of nutrients such as ash by the incineration method in a muffle furnace at 550°C, moisture content in hot air circulating oven, crude fat by soxhlet extractor, protein (N X 6.25) in Kjeldahl method (AOAC, 2019), carbohydrate content by difference, potassium by photometer method and magnesium by iodine method (AOAC, 2019) were done.

## 2.6 Statistical Analysis

Three replications were carried out for each trial in order to choose the best way to incorporate lemongrass. The values of each attribute under study were subjected to statistical analysis by one way ANOVA using SPSS Software 16.0. The significance of treatments effect was studied at 5% level of significance.

## 3. RESULTS AND DISCUSSION

Data indicated in the table 2 showed that the lemon grass incorporated all soup varieties were highly acceptable and comparable to the standard control. Based on the sensory evaluation, lemon grass incorporated radish soup with 20 percent incorporation level received the highest overall acceptability score of 24.2 out of 25 which is very closest rating of control sample (24.3). Figure 1 presents the mean overall acceptability score of the lemon grass incorporated radish soup varieties. Consistency and taste of the lemon grass incorporated soups were majorly affected compared to other parameters. The results of the organoleptic evaluation of appearance, colour and flavour in all soups formulas were not significant with control sample whereas taste and consistency were highly significant. However, lowest sensory rating was observed among lemon grass incorporated cabbage soup variations comparatively to other formulas. Highest sensory rating of 4.8 out of 5 was noted in appearance of radish soup incorporated with 20% lemon grass and it was lowest in 10 % lemon grass incorporation in cabbage soup. As far as the colour is concerned, the highest rating was seen in 20 % lemon grass incorporation in radish soup and lowest in 10 % lemon grass incorporation in mushroom soup. The highest flavour rating was seen among lemon grass incorporated radish variations and the lowest rating was noted among lemon grass incorporated cabbage soup varieties. A similar study result was noticed in the study of incorporation of brahmi leaves in health mic variation of the study of Anitha (2022). Mule *et al* (2018) has concluded in his study that lemon grass extract could be successfully utilized for preparation of herbal lassi.

Results from the Table 3 revealed that the nutritional qualities in regard to energy, protein, fat, magnesium and potassium of radish soups were increased as the incorporation level of lemon grass increases. The lemon grass is nutritional adequate and it proved that it contained high amount of potassium (135.82 mg) and magnesium (10.02 mg) which is merely closer to the requirement of control sample, however the increased incorporation level of lemon grass paste gave the higher contribution of nutrient content comparatively to the lowest incorporation. The highest percent of incorporation of lemon grass up to 20% level did not show any unacceptable changes in sensory qualities. Hence it is recommended that lemon grass paste can successfully be incorporated in soup varieties for the upliftment of nutritional and sensory attributes. Based on the recommendation of the study of Fernández-López *et al* (2020) statement that children's vegetable consumption is generally far below the recommended standards, and effective strategies are required to support additional consumption, attractive and nutritive soups could increase their vegetable consumption, this soup is one of the innovative and attractive one satisfies the requirement.

## 4. CONCLUSION

In present investigation, efforts were made to study the effect of improvement in sensory attributes and nutritional qualities of lemon grass incorporated mushroom, cabbage and radish soup varieties. The study revealed that the lemon grass has the stability to blend itself for the production of soups with slightly affecting the sensory attributes and nutritional qualities. Increase the concentration of lemon grass paste in soup formulas increases the nutritional content contribution. There is a significant increase in the sensory qualities of lemon grass incorporated soup variation with regard to taste and consistency particularly in lemon grass incorporated soup varieties. The lemongrass-incorporated radish soup was chosen as the best soup among all other variation as it possesses a good amount of nutrients as well as a significance in sensory attributes. Hence, lemongrass showed high potential as a functional ingredient for soups.



**Table 1.** Distribution of ingredients in different varieties of soups

Ingredients	Level of Incorporation in Soups				
	T0 0%	T1 5%	T2 10%	T3 15%	T4 20%
Mushroom (LGMS)	100gm	95gm	90gm	85gm	80gm
Radish (LGRS)	100gm	95gm	90gm	85gm	80gm
Cabbage (LGCS)	100gm	95gm	90gm	85gm	80gm
Lemongrass Paste	Nil	5gm	10gm	15gm	20gm
Onion	2gm	2gm	2gm	2gm	2gm
Red chillies	2gm	2gm	2gm	2gm	2gm
Ginger	2gm	2gm	2gm	2gm	2gm
Garlic	2gm	2gm	2gm	2gm	2gm
Corn flour	5gm	5gm	5gm	5gm	5gm
Water	150ml	150ml	150ml	150ml	150ml

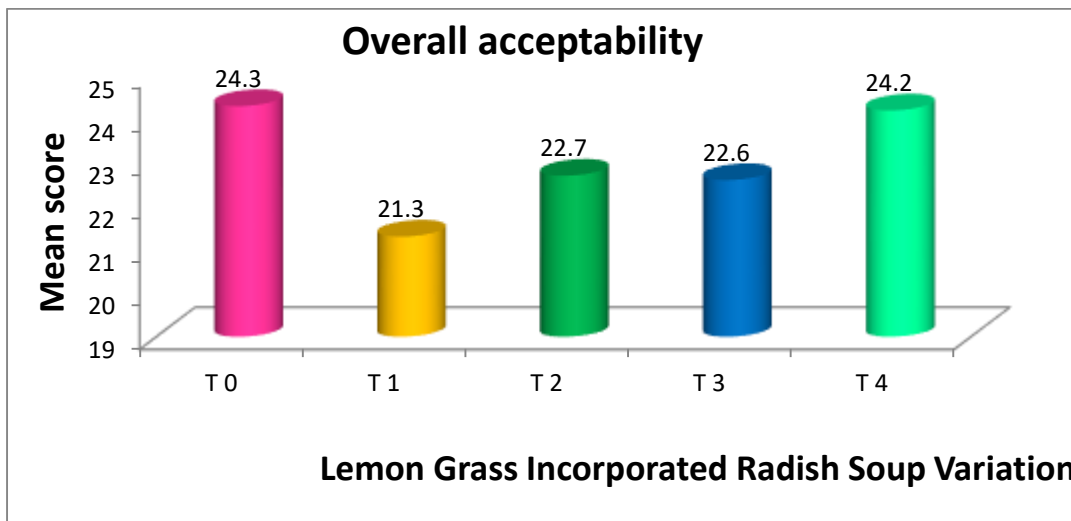
**Table 2.** Mean sensory scores of soups incorporated with lemon grass paste

Attributes	Contro l T0	LGMS				LGCS				LGRS			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Appearance	4.8 (0.22)	4.6 (0.66)	3.83 (0.62)	4.6 (0.66)	4.4 (0.89)	3.3 (0.12)	3.2 (0.22)	3.9 (0.53)	4.6 (0.66)	4.4 (0.18)	4.4 (0.08)	4.7 (0.14)	4.8 (0.94)
Colour	4.9 (0.23)	4.8 (0.18)	2.43 (0.41)	4.8 (0.18)	4.0 (0.77)	3.8 (0.11)	3.3 (0.23)	4.4 (0.1)	4.11 (0.18)	3.4 (0.08)	4.3 (0.14)	4.3 (0.57)	4.9 (0.89)
Flavour	4.9 (0.21)	4.7 (0.14)	3.4 (0.47)	4.7 (0.14)	4.2 (0.77)	3.2 (0.22)	4.6 (0.17)	3.6 (0.06)	4.17 (0.18)	4.6 (0.44)	4.6 (0.08)	4.2 (0.23)	4.8 (0.89)
Taste	4.9 (0.12)	4.9 (0.24)	2.85 (0.18)	4.9 (0.24)	4.6 (0.48)	3.4 (0.15)	4.6 (0.3)	4.8 (0.17)	4.9 (0.24)	4.2 (0.07)	4.6 (0.18)	4.6 (0.21)	4.9 (0.90)
Consistency	4.8 (2.43)	4.9 (0.17)	4.2 (2.5)	4.8 (3.5)	4.9 (3.4)	4.4 (0.12)	4.8 (0.56)	4.1 (0.78)	4.9 (0.87)	4.7 (0.93)	4.8 (0.23)	4.8 (0.34)	4.8 (0.45)
Overall Acceptability	24.3 (4.5)	23.9 (3.45)	16.71 (2.67)	17.6 (3.2)	22.1 (3.34)	18.1 (2.34)	20.5 (3.12)	20.8 (2.67)	22.68 (3.21)	21.3 (3.42)	22.7 (2.45)	22.6 (3.12)	24.2 (3.45)



**Table 3.** Nutritional Qualities of Lemon grass incorporated radish soup (LGRS)

Nutrient Content	Control T0	Lemon Grass Incorporated Radish Soup			
		T1	T2	T3	T4
Energy (kcal)	10.98	6.745	13.49	20.23	26.98
Protein (gm)	0.12g	0.08	0.16	0.24	0.32
Fat (gm)	1.74g	0.68	1.37	2.05	2.74
Potassium (gm)	132.3	135.82	271.65	407.45	543.3
Magnesium (gm)	10.18	10.02	20.04	30.06	40.08



**Figure 1:** Mean overall acceptability score of the Lemon Grass Incorporated Radish Soup varieties

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