Content available at: https://www.ipinnovative.com/open-access-journals

IP Journal of Nutrition, Metabolism and Health Science

Journal homepage: https://www.jnmhs.com/

Original Research Article

Impact of lemon grass (cymbopogon citratus) tea on the antioxidant and iron profile of non- Pregnant non- Lactating young women

Vanisha Nambiar[1,*], Hema Matela[1]

[1] *Dept. of Foods and Nutrition, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vodadara, Gujarat, India*

ARTICLE INFO

Article history:
Received 24-05-2022
Accepted 31-05-2022
Available online 12-07-2022

Keywords:
Lemon Grass
FRAP
CBC
Ferritin
Antioxidants
NPNL young women

ABSTRACT

Introduction: Cymbopogon citrates (Lemon Grass) is a traditional food of Asia and is used as folk medicine. Lemongrass has high antioxidant value; however, there is a dearth of human trials showing impact of Lemon Grass on health.
Objective: The present study was conducted to assess the impact of Lemon Grass supplementation on antioxidant and Iron profile of Non-Pregnant and Non Lactating Healthy Adult Women.
Materials and Methods: The 3.5g oven dried lemongrass tea (infused) was supplemented (twice daily) to non-pregnant non- lactating healthy adult women (19-25 years) for a period of 60 days.
Results: it was found that there was significant increase in antioxidant values as assessed by FRAP (17.1±4.3 to 25.5±6.6, $p \leq 0.000$). However, there was a 1.8% reduction in Hb (12.2±1.4 to 11.9±1.4g/dl ($p \leq 0.05$) levels with an insignificant decrease of Ferritin (6.7%), Erythrocyte (0.6%) Hematocrit (2.6%), MCH (0.5%) and MCHC (0.3%) values. Moreover, there was a decrease in normocytic normochromic subjects from 86.6 to 80.0 percent.
Conclusion: Lemon Grasstea contributes to enhanced antioxidant levels in adult women, however, its effects on the CBC levels need to be corroborated.

1. Introduction

Human antioxidant defences are effective, but they are not infallible. According to the Free Radical Theory; ageing results by a reduction of antioxidant enzymes and a continued damage of the macromolecules[1] Fruits and vegetables are low energy dense food relatively rich in vitamins, minerals and other bioactive compounds and are good source of fibres.[2] Several studies conducted have documented antioxidant potential of polyphenols in fruits and vegetables and their correlation in reducing the incidence of degenerative diseases.[3] According to WHO, insufficient consumption of fruits and vegetables are recognised as contributing risk factors to Non-Communicable Diseases (NCDs) burdenworldwide.[4] Thus herbal medicines are increasingly gaining acceptance from the public and medical professionalsas they positively influences the health and quality of life.

Lemon grass (LG) is being used as folk medicine since ages in different parts of the world. An earlier study conducted reported that Cymbopogon citratus were shown to have free radical scavenging effects.[5] There are limited clinical trialsavailable on impact of lemon grass on the antioxidant profile of the human population. An earlier study conducted determined antioxidant capacity of lemon grass by different methods i) DPPH (15.96±0.53 μmole TE/g dw) ii) FRAP (23.40±1.19 μmole TE/g dw) and iii) ABTS (31.50±0.13 μmole TE/g dw) to confirm its high

* *Corresponding author*.
E-mail address: vanisha.nambiar-fn@msubaroda.ac.in (V. Nambiar).

https://doi.org/10.18231/j.ijnmhs.2022.012

antioxidant property.[6]

The efficacy of phenolic-rich extracts should be assessed in terms of not only their antioxidant action in vitro but also their potential to interfere with iron absorption.[7] Polyphenols including EGCG have been shown to chelate metals such as iron.[8,9] High antioxidant foods such as tea, red wine, and other beverages rich in phenolic compounds, including coffee, are known to inhibit the absorption of non-hemeiron.[10,11] Hence, present study was conducted to assess the impact of LG supplementation on antioxidant and Iron profile of non- pregnant non- lactating young healthy women.

2. Materials and Methods

2.1. Experimental design

Time series.

2.2. Sample size

Following institutional ethical clearance, written consent, and snowball sampling technique, of the 150 students (19-25y), screened from the Department of Foods and Nutrition, Faculty of Family and Community Sciences, following the exclusion criteria and compliance data, the results are discussed for final 30 participants who completed the clinical trial.

2.3. Inclusion criteria

1. Subjects willing to complete the study.
2. Subjects who can provide blood samples.

2.4. Exclusion criteria

1. Illness, or any social events to attend during the study period or other academic commitments

2.4.1. Dose selection

Hypoglycaemic and hypolipidemic effects of the LG was seen when daily oral dose of 125-500 mg/kg body weight of fresh leaf aqueous extract of Cymbopogon citrates was supplemented to normal, male Wistar rats for 42 days.[12] Hence taking the reference body weight of Indian adult NPNL women (18-29yrs) as 55kg.,[13] the present study was planned to supplement lemon grass with the dose of 7.00 g/day using following calculation: 125mg/kg x 55kg =6875mg (6.8g).

2.4.2. Sensory evaluation

A study conducted reportedthat hot water extract of Cymbopogon citrates had high DPPH radical scavenging ability, Fe^{+2} chelating ability and OH^- scavenging ability than cold water extract;[14] therefore hot water extracts was selected as a mode of supplementation in the present study.

Single daily dose of the Lemon Grass tea was selected by a sensory panel using hedonic test.

Panellists were asked to evaluate coded samples of tea for degree of liking, on a 9-point scale which ranges from like extremely to dislike extremely. More than one sample may fall within the same category.

2.5. Laboratory investigation

2.5.1. Total Antioxidant Capacity (TAC)

The TAC was estimated by Ferric reducing-antioxidant power (FRAP)[15] as it does not measure substantial amounts of serum proteins, including albumin.[16] Chemicals from SIGMA industries were used for reagent preparation and this method is based on the reduction of a ferric Tripyridal Triazine (TPTZ) complex to its ferrous, coloured form in the presence of antioxidant.

2.5.2. Iron profile

The Sysmex lysing reagent was used for haematological indices and Hb was estimated by Cyanmethenoglobin method.

3. Results

3.1. Sensory evaluation: (Hedonic rating

It was found that the overall acceptability of the product C (3g of lemon grass) was highest followed by product B (2g) and product A (4g). According to the results obtained by Hedonic rating test, the present study was continued with the 3.5g of lemon grass tea in 150 ml of water (Table 1).

3.2. Details of products

Product A (4g LG), B (2g LG), C (3g LG) with 5g sugar and 150 ml water.

Table 1: Sensory attribute scores of the three recipes (Mean ± SD)

Sensory attribute	Product A	Product B	Product C	F value
Colour andappearance	6.2 ± 1.2	8.0 ± 1.2	7.0 ± 1.1	5.54*
Flavour and aroma	5.6 ± 1.9	7.5 ± 1.0	7.3 ± 1.4	4.52*
Overall acceptability	4.7 ± 1.6	7.4 ± 1.0	7.7 ± 1.2	15.16 ***

F test (****significantly different at p ≤ 0.000, ***significantly different at p ≤0.001, **significantly different at p ≤0.01,*significantly different at p≤ 0.05. NS – non significant)

3.2.1. Diet history

The dietary history was calculated from 24 Hour diet recall method (Table 2). It was found that RDA of macro as well as micro nutrients was not fulfilled except fat.

Table 2: Nutrient intake per day

Nutrient	Pre % RDA	Post % RDA
Energy (Kcal)	68.8	66.9
Protein(g)	73.0	64.8
Fat (g)	203.8	172.4
Carbohydrate(g)	49.9	51.8
Fibre(g)	37.1	33.1
Calcium(mg)	102.8	86.6
Iron(mg)	54.3	64.7
Zinc(mg)	43.7	41.3
Vit C(mg)	108.4	91.0
Thiamine(mg)	97.9	100.0
Riboflavin(mg)	57.1	46.6
Niacin(mg)	73.0	73.0
Vit B 6(mg)	5.1	13.2
Folate (mcg)	58.0	55.1
Vit B 12 (mcg)	3.0	4.6****
Retinol(mcg)	19.8	14.9
Beta Carotene(mcg)	20.3	16.5

****significantly different at p ≤ 0.000, ***significantly different at p ≤0.001, **significantly different at p ≤0.01,*significantly different at p≤ 0.05. NS= non- significant.

3.3. Intervention

During the supplementation phase minimum compliance rate ranged from 78% to 100%. Feed-back on liking and disliking of lemon grass tea was taken at two points. Initially only 53.3% of the subjects had liking for the tea, but towardsthe end of the supplementation it was increased to 73.3%.

3.4. Impact of supplementation on TAC

Impact of daily supplementation of lemon grass tea on the TAC revealed that overallthere was a significant increase in the mean antioxidant values from 17.1 to 25.5μmole TE/ml with mean compliance rate of 90%. The subjects were further alienated in to two groups: Hostelites (n=15) and day scholars (n=15).

It was seen that TACwas significantly improved among Hostelites as compare to day scholars. In day scholars serum antioxidant values increased from 18.2 to 24.3μmole TE/ml (25% increase) with 86.3% compliance rate whereas in Hostelites serum antioxidant values increased from 16.6-26.2μmole TE/ml (31.9% increase) with the better compliance of 95%. There was a significant correlation between compliance rate and increased antioxidant values (p ≤0.01). (Table 3)

Frequency distribution of serum antioxidant values depict that there was a marked increase in AO values after supplementation. At baseline 36.6%, 43.3%, 13.3%, 2.6% of the subjects had AO value as <15, 15-19.9, 20-24.9 and >25μmole TE/ml, respectively. Whereas at the endline (after supplementation) the trend had become upturned as none of them had AO less than 15μmole TE/ml.

Table 3: Impact of lemon grass tea on serum TAC (μmole TE/ml)

Variables	Pre data	Post data	Correlation with Compliance (r value)
Total subjects (N=30)	17.1± 4.3	25.5± 6.6****	0.540 **
Hostelites (n=15)	16.6± 4.1	26.2 ±7.5 ***	0.55 *
Day scholars (n=15)	18.2± 4.5	24.3± 5.6*	0.732**

****significantly different at p ≤ 0.000, ***significantly different at p ≤0.001, **significantly different at p ≤0.01,*significantly different at p≤ 0.05.

3.5. Impact of lemon grass on iron status indicators

3.5.1. Impact on Hb and ferritin levels

After Lemon grass supplementation it was observed that there was 1.8% (12.2 to 11.9 g/dl) decrease in the mean Haemoglobin levels of the subjects. There was a non-significant decrease in the Serum ferritin levels. To better understand the effect lemon grass on iron status other haematological indices were also studied (Table 4).

3.5.2. Other Haematological indices

After supplementation there was non- significant increase in Mean corpuscular volume (MCV). The mean corpuscular hemoglobin (MCH), Haematocrit, Mean Corpuscular Hemoglobin Concentration (MCHC) and erythrocyte values were non-significantly reduced (Table 4).

3.5.3. Impact on red cell Morphology

It was found that Normocytic normochromic individuals decreased from 86.6 to 80 percent and prevalence of abnormal morphology increased from 13.3% to 20.0%. Moreover it was found that microcytic hypochromic individual increased from 6.6 to 13.3%, whereas frequency of individuals having normocytic Hypochromic and Macrocytic red blood cells remains same (Table 5).

4. Discussion

In the present study after 60 days of supplementation of lemon grass there as a significant increase in serum antioxidant value (17.1 to 25.5μmole TE/ml). Lemon grass is proved as a strong antioxidant agent in-vivo hence complements the laboratory findings that it has antioxidant capacity. An earlier study conducted documented that Lemon Grass has better antioxidant capacitythan Coriander (leave and stem), Ginger, Tomatoand Garlic. And less TAC than Turmeric, Cumin, dried Curry powder.[17]

Table 4: Impact of supplementation on iron status indicators

Variables (N=30)	Pre data	Post data
Haemoglobin	12.2 ± 1.4	11.9± 1.4*
Ferritin (ng/ml)	21.0 ± 20.4	19.6± 18.7^{NS}
Erythrocyte (milli.cu.mm.)	4.4 ± 0.4	4.4 ± 0.4^{NS}
Hematocrit (PCV) (%)	37.8 ± 3.2	37.3 ± 3.6^{NS}
MCV (fl)	84.9 ± 7.3	84.9 ± 8.1^{NS}
MCH(pg)	27.3 ± 3.4	27.1 ± 3.5^{NS}
MCHC (g/dl)	32.0 ± 1.5	31.9 ± 1.6^{NS}

****significantly different at p ≤ 0.000, ***significantly different at p ≤0.001, **significantly different at p ≤0.01,*significantly different at p≤ 0.05. NS (non-significant).

Table 5: Impact on Red cell morphology of the subjects

Red cell morphology	Pre data % (n)	Post %(n)
Normocytic Normochromic	86.6 (26)	80 (24)
Normocytic Hypochromic	3.3 (1)	3.3 (1)
Microcytic Hypochromic	6.6 (2)	13.3(4)
Macrocytic	3.3 (1)	3.3 (1)

Studies conducted have also reported that lemon grass has high phenol and flavonoids content.[18] Polyphenolic monomers; particularly tannins are considered as antinutrient however more recently these compounds are considered as important dietary antioxidants.[19] Tea from the other sources like Camellia sinensis which is known source of antioxidant also inhibits the iron absorption,[20] coffee also was shown to inhibit iron absorption in humans in a dose-dependent manner.[21] It is proposed that the amount and category of polyphenols present in foods will compute the inhibitory effect, Cymbopogon citratus leaves had low concentrations of Phytate & oxalate (0.48mg/g) and Tannin was not detected,[22] therefore it can be predicted that lemon grass would have less interference on iron absorption than green and black tea.

Average Iron intake in studied population was found to be 13.6±4.4 which is only 65% of the RDA. Absorption of iron from various Indian diets was found to vary from 7-20%[23] and it is said that Ascorbic acid promotes iron absorption, this effect can be achieved with the amounts of ascorbic acid obtained in foods however, average Vitamin C intake of samples studied in present study was 54.6mg/d on comparing with other countries it is very low as Greek diet provides 214mg/d of vitamin C[24] and median daily intakes in the Spanish EPIC cohort was 137mg/d[25] which is very low therefore decrease in Hb. is not exclusively attributed to phenols present in lemon grass it is a cumulative outcome of inadequate consumption of dietary iron, low intake of absorption enhancer and additional phenol supplemented by lemon grass tea hence further studied are need to be done in this area.

5. Conclusion

Thus, it can be concluded that the LG tea had significant positive correlation on the TAC as assessed by serum FRAP analysis. Tea is the second most popular consumed beverages. As in the present study the taste of LG tea is acceptable, therefore for it can be an effective food based approach for improving antioxidant defence system of the body hence preventing degenerative diseases.

Quantity of lemon grass consumed is an important factor to be kept in mind for having positive health benefits as Lemon Grass is responsible for negative impact on bioavailability of iron therefore adequate iron absorption enhancer should be consumed.

Many other functional foods are easily available, underutilized and add to the overall antioxidant intake in daily diets such as drumstick leaves, radish leaves, pomegranate peels, cauliflower greens, Bael leaves, Amaranthus red and green leaves, coriander leaves and millets such as pearl millet[16–18,22] need to be promoted. Dietary diversity and healthy diet promotion at the community level is the need of the hour.

6. Conflict of Interest

None.

7. Source of Funding

None.

References

1. Adeneye AA, Agbaje EO. Hypoglycemic and hypolipidemic effects of fresh leaf aqueous extract of Cymbopogon citrates Stapf in rats. *J Ethnopharmacol*. 2007;112(3):440–4.
2. Agudo A, Cabrera L, Amiano P, Ardanaz E, Barricarte A, Berenguer T, et al. Fruit and vegetable intakes, dietary antioxidant nutrients, and total mortality in Spanish adults: findings from the Spanish cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC-Spain). *Am J Clin Nutr*. 2007;85(6):1634–42. doi:10.1093/ajcn/85.6.1634.
3. Apte SV, Venkatachalam PS. Iron absorption in human volunteers using high phytate cereal diet. *Indian J Med Res*. 1962;50:516–20.
4. Benzie IFF. Evolution of dietary antioxidants. *Comp Biochem Physiol A Mol Integr Physiol*. 2003;136(1):113–26. doi:10.1016/s1095-6433(02)00368-9.
5. Brvao L. Polyphenols: chemistry, dietary sources, metabolism, and nutritional significance. *Nutr Rev*. 1998;56(11):317–33. doi:10.1111/j.1753-4887.1998.tb01670.x.
6. Cao G, Prior RL. Comparison of different analytical methods for assessing total antioxidant capacity of human serum. *Clin Chem*. 1998;44(6 pt 1):1309–15.
7. Cheel J, Theoduloz C, Rodriäguez J, Hirschmann SG. Free Radical Scavengers and Antioxidants from Lemongrass (Cymbopogon citratusStapf). *J Agric Food Chem*. 2005;53(7):2511–7. doi:10.1021/jf0479766.
8. Cook JD, Reddy MB, Hurrell RF. The effect of red and white wines on non heme-iron absorption in humans. *Am J Clin Nutr*. 1995;61(4):800–4. doi:10.1093/ajcn/61.4.800.
9. Disler PB, Lynch SR, Charlton RW. The effect of tea on iron absorption. *Gut*. 1975;16(3):193–200. doi:10.1136/gut.16.3.193.
10. Elmadfa I, Weichselbaum E. Energy and nutrient intake in the European Union. *Forum Nutr Basel Karger*. 2004;58:19–46.

11. Guo Q, Zhao B, Li M, Shen S, Xin W. Studies on protective mechanisms of four components of green tea polyphenols against lipid peroxidation in synaptosomes. *Biochim Biophys Acta*. 1996;1304(3):210–22. doi:10.1016/s0005-2760(96)00122-1.
12. Kaltwasser JP, Werner E, Schalk K, Hansen C, Gottschalk R, Seidl C, et al. Clinical trial on the effect of regular tea drinking on iron accumulation in genetic haemochromatosis. *Gut*. 1998;43(5):699–704. doi:10.1136/gut.43.5.699.
13. Kaur C, Kapoor HC. Antioxidants in fruits and vegetables – the millennium's health. *Int J Food Sci Technol*. 2001;36(7):703–25.
14. Layrisse M, Garcia-Casal MN, Solano L, Baron MA, Arguello F, Llovera D, et al. Iron bioavailability in humans from breakfasts enriched with iron bis-glycine chelate, phytates and polyphenols. *J Nutr*. 2000;130(9):2195–9. doi:10.1093/jn/130.9.2195.
15. Nambiar VS, Daniel M, Guin P. Characterization of polyphenols from coriander leaves (Coriandrum sativum), red amaranthus (A. paniculatus) and green amaranthus (A. frumentaceus) using paper chromatography. *J Herbal Med Toxicol*. 2010;4(1):173–7.
16. Nambiar VS, Daniel M, Parnami S, Guin P. Impact of antioxidants from drumstick leaves on the lipid profile of hyperlipidemics. *J Herb Med Toxicol*. 2010;4(1):165–72.
17. Nambiar VS, Dhaduk JJ, Sareen N, Shahu T, Desai R. Potential functional implications of pearl millet (Pennisetum glaucum) in health and disease. *J Appl Pharm Sci*. 2011;1(10):62–7.
18. Nambiar VS, Matela H. Potential functions of lemon grass (Cymbopogon citratus) in health and disease. *Int J Pharm Biol Arch*. 2012;3(5):1035–43.
19. Nambiar VS, Matela H, Baptist A. Total antioxidant capacity using ferric reducing antioxidant power and 2, 2-diphenyl-1 picryl hydrazyl methods and phenolic composition of fresh and dried drumstick leaves. *Int J Green Pharm*. 2013;7(1):65–72. doi:10.4103/0973-8258.111626.
20. Nambiar VS, Mehta R, Daniel M. Polyphenol content of three Indian green leafy vegetables. *J Food Sci Technol*. 2005;42(6):312–5.
21. Nambiar VS, Sareen N, Daniel M, Gallego EB. Flavonoids and phenolic acids from pearl millet (Pennisetum glaucum) based foods and their functional implications. *Funct Foods Health Dis*. 2012;2(7):251–64.
22. Nambiar VS, Seshadri S. Retention of total and β-carotenes from fresh radish leaves in shallow-fried, steamed. *J Food Sci Technol*. 2012;38(5):458–61.
23. National Institute of Nutrition. Nutrient requirements and recommended dietary allowances for Indians; 2010. Available from: http://icmr.nic.in/final/RDA-2010.pdf.
24. Oboh G, Adefegha SA, Ademosun AO, Unu D. Effects of hot water treatment on the phenolic phytochemicals and antioxidant activities of lemon grass (cymbopogoncitratus) ejeafche. *Electronic J Environ, Agricultural Food Chem*. 2010;9(3):503–13.
25. Ohyoshi E, Hamada Y, Nakata K, Kohata S. The interaction between human and bovine serum albumin and zinc studied by a competitive spectrophotometry. *J Inorg Biochem*. 1999;75(3):213–8. doi:10.1016/s0162-0134(99)00090-2.

Author biography

Vanisha Nambiar, Professor

Hema Matela, Research Fellow

Cite this article: Nambiar V, Matela H. Impact of lemon grass (cymbopogon citratus) tea on the antioxidant and iron profile of non-Pregnant non- Lactating young women. *IP J Nutr Metab Health Sci* 2022;5(2):65-69.