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NUTRITIONAL AND PHYTOCHEMICAL STUDIES ON LEMON GRASS

(Cymbopogon citratus)

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ABSTRACT:

Cymbopogon citrates, commonly known as Lemon grass, is used extensively as herbal ingredient and health supplement in many parts of the world. The ability to uptake metals as nutrient from the soil and its environment which are so essential for their physiological and biochemical growth. Soxhlet extraction of the lemon grass leaves was carried out using hexane, acetone and dichloromethane solvents. pH of the extracts was acidic with range 5.1to5.6. Concentrations of ten elements, namely, Mg, Ca, Cr, Mn, Fe, Ni, Cu, Zn, Cd, and Pb were investigated using Atomic Absorption Spectroscopy (AAS) and compared with the permissible limits of FAO and WHO which are found to be within permissible limits. Toxic metals like Cd and Pb analysed are within the tolerable daily diet limit and at low concentration. Lemon grass can be used as antibiotic substances for possible treatment of bacterial and fungal infections.

Key words : Lemon grass extract, Soxhlet Extractor, Atomic Absorption Spectroscopy (AAS), metallic elements.

1.0 INTRODUCTION:

Cymbopogon is a genus of 45 species of grass, native to warm temperature and tropical regions. The most common of these species is C. Citratus, a tall perennial plant often called lemon grass. This species had been known and used traditionally by man since the ancient days. It is principally taken as tea to remedy digestive problems; diarrhoea and stomach ache (Carlin et al.,1986; Shah, et al 2011). Based on the claims of numerous health benefits derived from this plant, a number of studies were being conducted to investigate its actions, identify its phyto-constituents, and elucidate its toxicological profile in both human and animals, with new chemo types currently being developed. Several reviews have already appeared in literature on *C. Citratus*, describing its phytochemistry and its use as a medicinal plant (Negrelle & Gomes., 2007). These reviews provide a general overview of its applications in therapeutics, agriculture, cosmetics, and in food products.

Medicinal use of lemon grass is known to mankind since antiquity. It is believed to cure various ailments like cough, cold, spitting of blood, rheumatism, lumbago, digestive problems, bladder problems, leprosy, and as mouth wash for the toothache and swollen gums. It is also been claimed to be stimulating, diuretic, anti-purgative and to reduce fever (Stadtman, 1996). Similarly pharmacological investigation on the essential oil of C. citratus revealed that it has a depressant effect on the central nervous system (CNS) (Ayandele, 2007). It has analgesic and antipyretic properties.

The grass has been found to possess bactericidal and anti-fungal properties, which is comparable to penicillin in its effectiveness (Lutterodt et al, 1999). The oil also contains male sex hormone agent (Gupta et al., 1993). It is also reported to have strong activity against two dermatophytes, namely *Trichophyton rubrum* and *Microsporium gypsum* (Kokate et al., 1971). The extract juice from the lemon grass contains inhibitor of the promotion stage of carcinogenesis induced by cotton oil. It is an oral anti-tumour drug for the cancer and in combination with cyclodextrin lengthened the survival time (Parekh and Chanda, 2007; Oshiba and Tamada, 1991). Recent attention has been paid to extraction of biologically active components isolated from plant species. The medicinal value of plant lies in some chemical substances that produce a definite physiological action in human body. The most important of these active constituents are alkaloids, tannins, flavonoids, phlobotannins, saponins and cardiac glycoside (Edeoga et al., 2005). Microorganisms is a term used instead of microbes, they are small organisms that belongs to various groups: bacteria, fungi, protozoa, viruses, characterised by their unicellular structure.

C. citratus is an economically important aromatic perennial plant of the Poaceae family that has been used to extract essential oils. It is grown around the world and has a century -long record of extensive therapeutic applications in traditional medicine in a number of countries (Aftabet al, 2011 & Tarkang et el, 2012). It is used in herbal medicine for a wide range of applications based on its antibacterial, antifungal, antiprotozoal, anti-carcinogenic, anti-inflammatory, antioxidant, cardio protective, antitussive, antiseptic, and anti-rheumatic activities. It has also been used to inhibit platelet aggregation (Hutton, M.

(1987; Toynolini et al., 2006), treat diabetes, dyslipidaemia, gastrointestinal disturbances, anxiety, malaria, flu, fever, and pneumonia (Negrelle et al., 2007), as well as in aromatherapy. In addition to its therapeutic uses, *C. Citratus* is also consumed as a tea, added to non-alcoholic beverages and baked food, and used as a flavouring and preservative in confections and cuisines. In cosmetics, it's essential oils are used as fragrance in the manufacture of perfumes, soaps, detergents, and creams (Lorenzetti, 1991 & De-oliveira et al., 1997). Lemon grass is also a panacea for cough, elephantiasis, flu, gingivitis, headache, leprosy, malaria, ophthalmic, pneumonia and vascular disorders (Negrelle et al., 2007, Numbiar, U. S.,and Matela, H. 2012, Hutton, M. 1987)).

2.0 MATERIALS AND METHODS

2.1 Sampling:

The samples of *Cymbopogon citratus* were collected at random from home gardens at Ikot Abasi and Mkpat Enin local government areas where the plant has been cultivated for commercial purpose and domestically for various medicinal properties. The plant samples were freshly cut from the stem in the morning, washed with clean water and brought for Soxhlet extraction.

2.2 Sample preparation:

The lemon grass leaf samples were stored in airy sacks and transported to the laboratory. The leaves were neatly chopped into smaller pieces to provide larger surface area to ensure efficient extractability.

2.3 Chemicals and Reagents:

All chemicals used were of pure and analytical grade from the chemical store of chemistry department, Akwa Ibom State University, Ikot Akpaden, Mkpat Enin. Acetone, dichloromethane, and hexane were used as the extraction solvents. Glass wares used include conical flasks, measuring cylinders, petri dishes and beakers.

2.4 Soxhlet Extraction:

Extraction methods were compared (Schareberg, et al. (2002).) Three different solvents were chosen viz; dichloromethane, hexane and acetone. It was necessary to establish which solvent was the most appropriate for the extraction process with the optimum extraction yield. Extractions were carried out on the dried leaves by weighing samples 100 g of finely chopped plant material and extracting with 500 mL of hexane, acetone and dichloromethane as solvents, for 10 hours respectively. The extracts were later dried using rotary evaporator. The choice of Soxhlet extraction was made because the apparatus is cheap easily assembled and could be available in every laboratory. Its demerits include use of long time and large volume of solvents.

2.5 Plant Sample Digestion:

0.5 g of the plant samples was weighed and was digested for 3 h at 85°C with concentrated HNO_3 : HCl (3 : 1) mixture. Then concentrated HClO4 (1 mL) was added to enhance the oxidation properties in the digestion. The solutions were filtered and diluted to 50 mL with distilled water. The blank solution was taken with the same procedure without addition of the sample.

2.6 Instrumentation:

Thermo Elemental Atomic Absorption Spectroscopy (AAS), Solar 969 model was employed in the analysis of the concentration levels of metals reported further in this article..

3. 0 RESULTS AND DISCUSSION

3.1 Extraction:

Three solvents, Dichloromethane (DCM), Acetone, (Ac) and Hexane (H) were used; one after the other with the same condition. Hexane proved to be the most suitable solvent over acetone and dichloromethane for this extraction due to its efficiency and optimum yield of the extracts as shown on table 1.

Table 1: Weight of extracts obtained from extraction solvents

Solvents	**Weight of extract (g)**
Acetone	4.6
Hexane	8.3
Dichloromethane	3.1

The pH of the different extracts were recorded before analysis and results showed that they were all acidic with values ranging from 5.0 to 5.6 (table 2).

Table 2: pH values of the Lemon grass extracts.

Solvent	Acetone	Hexane	Dichloromethane
pH	5.2	5.6	5.1

The pH of the various extracts is more acidic than that of ordinary water (6.5-74). The continuous consumption of this low pH drink extract may cause ionic imbalance of the essential elements in the body system.

Analysis of the metallic elements, namely, Mg, Ca, Cr, Mn, Fe, Ni, Cu, Zn, Mo, As, Cd, and Pb, was performed on the samples of *Cymbopogon citrates*. The elemental levels analyzed in the leaf extracts of the three solvents are given in Table 3.

Table 3. Mean concentration levels (mg/kg) of the elements contained in Lemon grass extracts.

Elements	Acetone Extract	Dichloromethane Extract	Hexane Extract
Ca	4.123	5.015	4.283
Fe	1.627	1.914	1.186
Mg	0.793	0.796	0.754
Cu	0.071	0.078	0.054
Ni	0.004	0.006	0.010
Pb	0.001	0.002	0.001
Mn	0.255	0.271	0.193
Zn	0.087	0.106	0.103
Cd	0.020	0.026	0.017

Dichloromethane extracts gave the highest concentration in all the metals analysed despite the fact that it was the least amount extracted. The level of Calcium, (Ca) in this extracts ranges from 4.123 to 5.015 mg/kg and plays a vital function in the metabolic functions of the body.

Iron, (Fe) content of the extracts has the highest concentration which ranges from 1.914 to1.627 mg/kg. It implies that people taking this Iron rich leaf extract are not likely to suffer from iron deficiency which causes anemia.

The concentration of Magnesium, (Mg) in the leaf extract was between 0.754 to 0.796 mg/kg. This metal functions in protein synthesis and is a cofactor of enzymes.

The level of concentration of Copper, (Cu) ranges from 0.054 to 0.078 mg/kg. Cu forms one of the organometallic component of the body which functions as a metalloenzymes and regulates the immune functions and cholesterol and glucose metabolism.

Nickel, (Ni) is said to influence iron absorption and body metabolism and the concentration range of 0.004 to 0.010 mg/kg in the lemon grass extract is quite necessarily significant. Manganese, (Mn) is required for the normal growth and development of the body and was available in the range of 0.193 to 0.271 mg/kg (Vincent, J. B. (2010; Bowman et al, 2011).

Zinc, (Zn) was found between 0.087 to 0.106 mg/kg and its consumption furnishes the enzymes that participate in the synthesis and degradation of carbohydrates, lipids, proteins, and nucleic acids as well as in the metabolism of other micronutrients. The concentrations of these metals fall within the WHO/USP tolerable intake limits. As shown in table 4.

Lead, (Pb) (0.001 0.002 mg/kg) and Cadmium (Cd) (0.017 to 0.026 mg/kg)are the only heavy and toxic metals in the extract and their concentrations are very low, tolerable and therefore not toxic if consumed according to USP and California standard (table 4).

Table 4: Accepted standards for tolerable daily intake of heavy metals in ingested products.

Metals	USP	CS	WHO	Experimental Results
Lead	10.0 ppm	0.5 μg	75.0 µg	0.003 (mean)
Cadmium	3.0 ppm	4.1 μg	-	0.021 (mean)

USP = United States Pharmacopeia; CS = California Standard, WHO = World Health Organization.

The above reference table records maximum limit, for cadmium as 1.0 mg/kg, and lead as 0.5 mg/kg. This is acceptable level based on USP and CS standard despite that they have an inherent toxicity with a tendency to accumulate. Heavy metals can, in certain quantities, cause disease, can be carcinogenic, could have adverse reproductive effects, unfavorably impact nutrition, and may displace more biologically useful metals such as calcium and zinc.

4.0 CONCLUSION

Lemon grass extract is widely taken in Nigeria because of its aromatic flavour and for its many health beneficial properties. The nutrients intake from various tea beverages is well-known though oral intake of nonessential and toxic elements cannot be ruled out as plants can uptake them from the soil and its environment. The effect of trace heavy metals on human health and the environment have attracted substantial awareness and concern in recent time.

In this work the level of Lead is within the tolerable and non lethal limit. However, Lead is known to induce renal tumours, reduce cognitive development, increase blood pressure and cardiovascular diseases in adults. The human brain is most affected by lead intake.

The analyzed metallic concentrations in the lemon grass extract fall within the allowed consumable level that gives health supplements. The health hazard effect level of the toxic metals such as Cd and Pb was absent in all the investigated lemon grass samples.

5.2 RECOMMENDATION

It is recommended that consumption of lemon grass as health supplements and essential nutrients for their Ca, Zn, Fe and Mn content should be monitored due to their natural geochemical association with these essential metals so as to provide citizens the safe and non-hazardous living.The taking this extracts are generally used without prescriptions, proper counselling or any awareness of the health risks, hence the consumers should be properly guided by health workers.

Further research will be to identify the concentration strength of lemongrass leaves extract that is able to prevent the growth of fungi.

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