



Journal of Medical Sciences

ISSN 1682-4474

science
alert

ANSI*net*
an open access publisher
<http://ansinet.com>

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued eight times per year on paper and in electronic format.

For further information about this article or if you need reprints, please contact:

B.C. Akin-Osanaiye
National Research Institute for
Chemical Technology,
Private Mail Bag 1052,
Zaria, Nigeria

J. Med. Sci., 7 (4): 694-697
15th May, 2007

Antimicrobial Activity of Oils and Extracts of *Cymbopogon citratus* (Lemon Grass), *Eucalyptus citriodora* and *Eucalyptus camadulensis*

B.C. Akin-Osanaiye, A.S. Agbaji and M.A. Dakare

The antimicrobial potentials of essential oils and extracts from the leaves of *Cymbopogon citratus* (Lemon grass), *Eucalyptus citriodora* and *Eucalyptus camadulensis* were tested on *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli*. Both the water extract and freeze dried extract of these leaves were used. Zone of inhibition measurement showed that *Eucalyptus citriodora* oil was very effective against *Salmonella typhi* and found to suppress growth of the organism after 24 h of incubation. Similar observation was made with a combined extract of *Eucalyptus citriodora* oil and lemon grass oil. Lemon grass oil was observed to possess high antimicrobial activity on all the three organisms tested while *Eucalyptus camadulensis* is very active against *Staphylococcus aureus*. Both the freeze dried extracts and the viscous extracts possess slight antimicrobial activity while in all cases, the aqueous extracts have no effects on the organisms.

Key words: Antimicrobial, essential oils, aqueous extracts

INTRODUCTION

Nature has been a source of medicinal agents for thousands of years and since the beginning of man. In Nigeria, almost all plants are medicinal and the application of medicinal plants especially in traditional medicine is currently well acknowledged and established as a viable profession (Kafaru, 1994).

In the past, there have been reports on prevalence of infections caused by *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli* and these organisms show resistant to most commonly used drugs. The consequence is that, newer drugs will have to be researched for, to enhance the treatment of people suffering from infections caused by these three microorganisms and one way of searching for new drugs is by studying locally used medicinal plants (Ebana *et al.*, 1986, 1995).

Presently in the developing countries, synthetic drugs are not only expensive and inadequate for treatment of diseases but are also often with adulterations and side effects (Shariff, 2001). There is therefore the need to search for plants of medicinal value. Although. The anti microbial and the antibacterial activities have been reported on the methanolic extract of these plants (Babayi *et al.*, 2004; Mehraban *et al.*, 2005; Rogerio *et al.*, 2004); there has been little or no documented scientific evidence on their water extracts on these organism.

The essential oils used in this study were extracted from two different Eucalyptus species (*Citriodora* and *camadulensis*) and *Cymbopogon citratus* (Lemon grass) plants, which are used traditionally for the treatment of malaria and typhoid fever. Concoction prepared from the combination of the leaves and grass of these plants or the boiling of the individual plant leaves have been used in the treatment of ailments like typhoid fever, stomach ache etc. (Udeh *et al.*, 2001). These oils have applications in the soap, cosmetics and perfumery industries. The main objective of this study is to examine antimicrobial activities of water extracts and the essential (volatile) oils from the leaves of *Cymbopogon citratus*, *Eucalyptus citriodora* and *Eucalyptus camadulensis*.

MATERIALS AND METHODS

Plant materials: The Eucalyptus (*Eucalyptus citriodora* and *Eucalyptus camadulensis*) leaves were obtained from different trees of the Forestry Plantation in Samaru, Zaria while lemon grass was obtained from NARICT, Basawa, Zaria.both in Kaduna State, Nigeria.

Test organism: The test microorganisms (*Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli*) were clinical isolates obtained from Department of Microbiology, Ahmadu Bello University, Zaria Nigeria. The three microorganisms were stock cultured using nutrient agar and incubated in the incubator at 37°C for subsequent use.

Preparation of water extract and the essential oil: Water extracts of the leaves were also prepared. A portion of the leaves was washed and dried in the oven at 100°C for 24 h. The dried leaves were then ground, soaked in water for 10 h and filtered using filter paper. The aqueous extract was frozen and then freeze dried to give the extract powder. The molten extract was obtained by boiling the leaves for 1 h. Another portion of the leaves was placed in distilled water and boiled for 1 h. The leaves were then filtered and the aqueous extract was evaporated on a heater to give the viscous extract.

The essential oils from plant samples were obtained from fresh leaves of these plants by simple distillation using a fabricated distillation apparatus designed and constructed by the National Research Institute for Chemical Technology (NARICT) Zaria, Nigeria, using the hydrodistillation technique. The oils were redistilled using simple distillation glass. This is to test the accuracy of the locally fabricated distillation set.

Microbial tests of plants extract and oils: The antimicrobial activity of both the essential oil and the extracts of lemon grass, *Eucalyptus citriodora* and *Eucalyptus camadulensis*, was carried out using the Punch hole diffusion technique described by Rogerio *et al.* (2004). Nutrient agar was used as the medium. 28 g L⁻¹ of the agar was autoclaved along side with the petri dishes at 121°C for 15 min (Cheesbrough, 1984). The plates of diameter of 90 mm were poured and inoculated with the test microorganisms by streaking. A hole (3 mm) was punched in the center of the plate using micro-borers. Three drops of each extract and essential oil was dropped into the punched hole using Pasteur pipette. The plates were then incubated at 37°C for 24 h. The zones of inhibition were measured using a transparent meter rule across the hole at different dimensions. The oils of *Eucalyptus citriodora* and Lemon grass which contain the same citral compounds were combined in the same ratio to know their combining effect, whether synergistic additive or antagonistic.

One gram of the freeze dried extract was dissolved in 1 cm³ distilled water while 1 g of the viscous extract was

dissolved in 0.5 cm³ distilled water and stirred until a homogenous solution was obtained. Three drops of each of these solutions were also put into the punched hole and the procedure was repeated for all the rest samples.

RESULTS AND DISCUSSION

The zones of inhibition representing the antimicrobial activity of the essential oils and their extract of the leaves of *Eucalyptus citriodora* and *Eucalyptus camadulensis* and Lemon grass on *Salmonella typhi*, *Staphylococcus aureus* and *Escherichia coli* after 24 h of incubation are presented in Table 1-3. The zones of inhibition were measured in millimeter (mm) and compared to the diameter of the plates used which was 90 mm. From the results presented on the Table 1-3, it was observed that *Eucalyptus citriodora* possess the greatest antimicrobial activity in any state used on *Salmonella typhi*, Lemon grass possess highest activity the three test organisms while *Eucalyptus camadulensis* possess the highest inhibitory effect on *Staphylococcus aureus*. This is in support with what was reported on the methanolic extract of these plants on these organism by Babayi *et al.* (2004). When Lemon grass oil and *Eucalyptus citriodora* (Lemon scent) were combined, they showed very high synergistic effect on the three microorganisms. These results are in accordance with what was reported by Udeh *et al.* (2001). They reported that *Staphylococcus aureus* showed indications of high susceptibility to the oil of *Eucalyptus citriodora* even at high dilutions of the crude oil so also Lemon grass (*Cymbopogon citratus*). It was also observed that some of the oils are highly inhibitory such that they inhibit growth absolutely of the microorganisms after 24 h of incubation. The extracts obtained from these plants possess a low or moderate inhibitory effect to growth of the test organisms. However, the aqueous extract of these plant leaves possess no inhibitory effect. This may be due to the fact that the active ingredients in this extract could not be extracted with water as the solvent. However, the methanolic extracts of these plants showed a very high antimicrobial sensitivity against some pathogenic microorganism (Babayi *et al.*, 2004). Mehran *et al.* (2005), reported that essential oils of *Cytopogon citratus* and *Eucalytus citrodora* showed 100% inhibition of mycelia growth and germination of spores of *Didymella bryoniae*.

Generally speaking, the oils of these plants are seen to possess amazing inhibitory effects on the three microorganisms. The combined lemon grass and *Eucalyptus citriodora* oils possess synergistic effect on all the three tests organisms. No marked demarcation between the viscous and powder extracts inhibitory

Table 1: Effects of essential oils from *Cymbopogon citratus*, *Eucalyptus citriodora* and *Eucalyptus camadulensis* and their different extracts on *Salmonella typhi*

Organism	Essential oils/Water extracts	Zones of inhibition (mm)
<i>Salmonella typhi</i>	<i>Eucalyptus camadulensis</i> oil	56.5
	<i>Eucalyptus camadulensis</i> powder	9.5
	<i>Eucalyptus camadulensis</i> molten	3.0
	<i>Eucalyptus citriodora</i> oil	No growth
	<i>Eucalyptus citriodora</i> powder	29.5
	<i>Eucalyptus citriodora</i> viscous	23.0
	<i>Cymbopogon citratus</i> oil	No growth
	<i>Cymbopogon citratus</i> powder	28.5
	<i>Cymbopogon citratus</i> viscous	17.0
	<i>Eucalyptus citriodora</i> and <i>Cymbopogon citratus</i> l	No growth (Synergistic effect)

Table 2: Effects of essential oils from, *Cymbopogon citratus* *Eucalyptus citriodora* and *Eucalyptus camadulensis* and their water extracts on the bacterium *Staphylococcus aureus*

Organism	Essential oils/Water extracts	Zones of inhibition (mm)
<i>Staphylococcus aureus</i>	<i>Eucalyptus camadulensis</i> oil	No growth
	<i>Eucalyptus camadulensis</i> power	26.5
	<i>Eucalyptus camadulensis</i> viscous	27.0
	<i>Eucalyptus citriodora</i> oil	80.0
	<i>Eucalyptus citriodora</i> powder	21.0
	<i>Eucalyptus citriodora</i> viscous	18.0
	<i>Cymbopogon citratus</i> oil	85.0
	<i>Cymbopogon citratus</i> powder	17.0
	<i>Cymbopogon citratus</i> viscous	13.0
	<i>Eucalyptus citriodora</i> and <i>Cymbopogon citratus</i> l	No growth

Table 3: Inhibitory effects of essential oils from *Cymbopogon citratus*, *Eucalyptus citriodora* and *Eucalyptus camadulensis* and their different extracts on *Escherichia coli*

Organism	Essential oils/Water extracts	Zones of inhibition (mm)
<i>Escherichia coli</i>	<i>Eucalyptus camadulensis</i> oil	80.5
	<i>Eucalyptus camadulensis</i> power	41.5
	<i>Eucalyptus camadulensis</i> viscous	36.0
	<i>Eucalyptus citriodora</i> oil	62.0
	<i>Eucalyptus citriodora</i> powder	20.0
	<i>Eucalyptus citriodora</i> viscous	17.5
	<i>Cymbopogon citratus</i> oil	No growth
	<i>Cymbopogon citratus</i> powder	21.50
	<i>Cymbopogon citratus</i> viscous	18.50
	<i>Eucalyptus citriodora</i> and <i>Cymbopogon citratus</i> l	No growth

effects on the organisms. The present study has demonstrated that the essential oils of Lemon grass, *Eucalyptus citriodora* and *Eucalyptus camaldulensis* have significant antimicrobial potentials.

REFERENCES

- Babayi, H., I. Kolo, J.I. Okogun and U.J.J. Ijah, 2004. The antimicrobial activities of methanolic extracts of *Eucalyptus camadulensis* and *Terminalia catappa* against some pathogenic microorganisms. *Biokemistri*, 16: 106-111.

- Cheesbrough, M., 1984. Medical Laboratory Manual for Tropical Countries (Vol. 2), Microbiology Butterworth and Co. Ltd., Britain, pp: 198-200.
- Ebana, R.U.B., O.U. Eka and O.D. Ekpa, 1986. Studies on the antimicrobial effect of extract of five plants that possess bittering property. A paper delivered at University of Calabar During the 14th Annual Conference and 3rd African Regional New Work on Microbiology.
- Ebana, R.U.B., A.A. Essies and O.D. Ekpa, 1995. Nutritional and Potentially medicinal values of the leaves of *La Sionthera Africana* (Bea UV). *Global J. Pure Applied Sci.*, 1: 1-8.
- Kafaru, E., 1994. Immense Help from Natures Workshop. Elika Health Services Ltd., Academic Press Plc. Lagos, Nigeria, pp: 1-27.
- Mehraban, F., O.T. Nasim and J. Fereshteh, 2005. Anti dermatophyte activities of *Eucalyptus camaldulensis* in comparism with Griseofulvin. *Iranian J. Pharmacol. Therap.*, 4: 80-83.
- Rogério, S.P., C.S. Tania, R.F. Marcos, O.C.J. Antonio and U. Mariko, 2004. Antimicrobial activity of essential oils on microorganisms isolated from urinary tract infection. *Rev. Saude Publica*, Vol. 38, No. 2 Sao Paulo.
- Shariff, Z.U., 2001. Modern Herbal Therapy for Common Ailments. Nature Pharmacy Series (Vol. 1), Spectrum Books Ltd., Ibadan, Nigeria in Association with Safari Books (Export) Limited, United Kingdom, pp: 9-84.
- Udeh, M.U., A.S. Agbaji, I.S.P. Williams, P. Ehinmidu, E. Ekpa and M. Dakare, 2001. Screening for the antimicrobial potentials of *Azadirachta indica* seed oil and essential oils from *Cymbopogon ciratus* and *Eucalyptus citriodora* leaves. *Nig. J. Biochem. Mol. Biol. Proc. Supplement*, 16: 189-192.