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## Comparative study on the Antimicrobial activities of the Ethanolic extracts of Lemon grass and Polyalthia Longifolia

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### ABSTRACT

The ethanolic extracts of the leaves of Lemon grass and Polyalthia Longifolia were subjected to antibacterial activity study. The study indicated that the extract of the leaves of Lemon grass was very active against *Klebsiella pneumonia* and *Staphylococcus aureus* at 25mg/ml but has no activity with *Bacillus subtilis* and *Escherichia coli* at the same concentration. The extract of Polyalthia Longifolia leaves was very active against *Bacillus subtilis* and *Staphylococcus aureus* at 25mg/ml but has no activity with *Klebsiella pneumonia* and *Escherichia coli* at the same concentration. The extracts when combined together can act synergistically with one another against *Staphylococcus aureus*, where one extract can potentiate the activity of another extract against *Staphylococcus aureus*. The minimum inhibitory concentration (MIC) of the crude extracts were determined for the various organisms which ranged between 0.01 and 2.5mg/ml, while the minimum bactericidal concentration (MBC) ranged between 0.02 and 2.5mg/ml.

**Keywords:** Antibacterial activity, minimum inhibitory concentration, minimum bactericidal concentration, lemon grass, polyalthia longifolia, ethanolic extracts.

### INTRODUCTION

Lemon grass (*Cymbopogon citratus*) belongs to the family *Poaceae*. It is a tall perennial grass with slender sharp edge green leaves that have a pointed apex. It is a native to warm temperate and tropical regions (Bleasel *et al.*, 2002). Lemon grass oil is used as a pesticide and preservative, it is also used as an antifungal agent (Shadab *et al.*, 2001). It is used as perfumes in soap, creams, candles and detergents. Lemon grass tea can be used to treat fever, cold, cough and stomach upset (Leite *et al.*, 2000). The tea has diuretic properties and water retention, making it helpful in individual with high blood pressure. The tea can also help to prevent typhoid fever, cancer and blurring of vision. It can help to relieve menstrual problems and nausea. The tea can help to lower cholesterol levels. Lemon grass can be used in herbal medicine to treat nervous condition and inflammation. It can also be used to treat chest infections, sores, muscle cramps and headache (Leite *et al.*, 2000). The plant Polyalthia Longifolia belongs to the family *Annonaceae*. It occurs mainly in Africa, Asia, Australia, India and New Zealand. The plant is locally known as Ashoka and is commonly cultivated in Pakistan and Sri Lanka. The extracts of Polyalthia Longifolia is traditionally used to lower blood pressure, stimulate respiration and help in fever and skin diseases, diabetes and hypertension (Nair *et al.*, 2000). Various parts of the plant are used to treat uterus ailment, gonorrhoea, leucorrhoea and menorrhagia. Polyalthia Longifolia is used as an antipyretic agent in indigenous systems of medicine. Pharmacologic studies on the bark and leaves of this plant show effective antimicrobial activity, cytotoxic function, antiulcer activity,

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hypoglycaemic activity and hypotensive effect (Saleem *et al.*, 2005; Chen *et al.*, 2000 and Nair *et al.*, 2007). Extracts from the bark of *Polyalthia Longifolia* can be used to cure mouth ulcer (Raghunathan and Mitra, 2002). Medicinal plants are very important to human beings in preserving our health (Bhagwati, 2003). The use of antibiotics to control diseases produces adverse toxicity to the host organs, tissues and cells. The toxicity produced by the antimicrobial agents can be prevented by using herbs. Lemon grass and *Polyalthia Longifolia* are being used in traditional medicine. The aim of the study was to carry out a comparative study on the antibacterial activities of the ethanolic extracts of the leaves of these plants.

## MATERIALS AND METHODS

### Collection of plant materials

The Lemon grass and *Polyalthia Longifolia* leaves were collected within Sheda Science and Technology Complex, in Abuja, Nigeria.

### Test organisms

The test organisms: *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli* and *Bacillus subtilis* were collected from the medical laboratory of the University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria. The bacterial isolates were first subcultured in a nutrient broth (oxoid) and incubated at 37°C for 18h.

### Preparation of ethanolic extracts

Fresh leaves of Lemon grass and *Polyalthia Longifolia* were washed and air dried in the laboratory for two weeks. They were ground with Excella mixer grinder and sieved with a mesh of size 0.5mm. The powdered samples obtained were stored in clean air tight containers at ambient temperature until when needed for use (Uzama, 2009 and Hassan *et al.*, 2005). The leaves powdered (50g) was placed in a 500ml conical flask. To this was added 250ml of ethanol and stirred vigorously with a magnetic stirrer. This was allowed to stand for 36h after which it was stirred and filtered. The extracts was concentrated using a rotary evaporator to 50ml. The extracts were cooled and stored in a refrigerator for analysis (Uzama, 2009).

### Phytochemical screening of ethanolic extracts

The phytochemical components of the leaves of Lemon grass and *Polyalthia Longifolia* were screened by using the standard methods of Uzama, 2009, Hassan *et al.*, 2005, and Odebiyi and Sofowora, 1978.

### Preparation of inoculum

The stock cultures were maintained at 4°C on slopes of nutrient agar, while the active cultures for the experiments were prepared by transferring a loopful of cells from the stock cultures to test tubes of Mueller-Hinton broth (MHB) (oxoid England) for bacteria, and was incubated without agitation for 24h at 37°C.

### Antibacterial screening

An invitro antimicrobial screening was carried out using Mueller Hinton Agar (MHA) (Oxoid, England) by Agar well diffusion method according to Perez *et al.* (1990). The plates were allowed to stand for one hour for pre-diffusion of the extract into the medium (Esimone *et al.*, 1998).

### Minimum inhibitory concentration (MIC)

The minimum inhibitory concentration was determined by incorporating various concentrations of solutions of extract in Mueller-Hinton Agar (200 – 0.4mg). A loopful of standard test bacterial broth cultures were used to streak plates. The plates of bacteria and extract were incubated at 37°C for 24h. A positive control containing only the growth medium and extract was also set up. The MIC was regarded as the lowest concentration of the extract that did not permit any visible growth of the organism.

### Minimum bactericidal concentration (MBC)

The minimum bactericidal concentration was determined by sub-culturing the test dilution on MHA without any growth on MHB and further incubated for 24h at 36°C. The lowest concentration that yielded no bacterial growth was taken as the minimum bactericidal concentration.

## RESULTS AND DISCUSSION

### Phytochemical analysis

The phytochemical analysis of the ethanolic extract of *Polyalthia Longifolia* indicated the presence of Tannins, while that of Lemon grass indicated Flavonoids and Tannins (Table 1).

**Table 1:** Phytochemical analysis of the ethanolic extracts of *Polyalthia Longifolia* and Lemon grass.

S/N	Phytochemicals	PE	LE
1	Alkaloids	-	-
2	Flavonoids	-	+
3	Glycosides	-	-
4	Carbohydrates	-	-
5	Saponins	-	-
6	Tannins	+	+
7	Terpenoids	-	-
8	Resins	-	-
9	Steroids	-	-

+ = Present  
- = Absent  
PE - *Polyalthia Longifolia* ethanolic extract  
LE - Lemon grass ethanolic extract

### Antibacterial activities

The results of antibacterial activities of the ethanolic extracts of the leaves of Lemon grass and *Polyalthia Longifolia* are given in Table 2. The results indicated that the ethanolic extract of Lemon grass exhibited antibacterial activity against *Klebsiella pneumoniae* and *Staphylococcus aureus*, while the ethanolic extract of *Polyalthia Longifolia* showed antibacterial activity against *Bacillus subtilis* and *Staphylococcus aureus*. This shows that the ethanolic extracts of Lemon grass and *Polyalthia Longifolia* are all active against *Staphylococcus aureus*. These extracts can act synergistically against *Staphylococcus aureus* when combined

together. The result showed that the extracts were very active antibacterial. The activity of the ethanolic extract of Polyalthia Longifolia was comparable to that of the antibacterial, Chloramphenicol (22.3mm) and Ciprofloxacin (24mm). Comparing the two ethanolic extracts of Lemon grass and Polyalthia Longifolia leaves, it can be said that the Polyalthia Longifolia extract is more active than the Lemon grass extract.

**Table 2:** Antibacterial activity of the ethanolic extracts of Lemon grass and Polyalthia Longifolia.

S/N	Test Organism	Zone of inhibition (mm)			
		Antibiotics			
		PE	LE	CP	CF
1	<i>Klebsiella pneumonia</i>	NA	16.7	19.3	24
2	<i>Escherichia coli</i>	NA	NA	31.2	NA
3	<i>Bacillus subtilis</i>	NA	21.7	22.3	24
4	<i>Staphylococcus aureus</i>	18.3	22	24	30.7

PE – Polyalthia Longifolia ethanolic extract

LE – Lemon grass ethanolic extract

NA – No activity.

CP – Chloramphenicol

CF – Ciprofloxacin

The minimum inhibitory concentration (MIC) of the ethanolic extracts of the leaves of Lemon grass and Polyalthia Longifolia ranged between 0.01 and 2.5mg/ml. The minimum bactericidal concentration (MBC) ranged between 0.02 and 2.0mg/ml. The results of antibacterial activity of the two extracts suggests the combination of the two extracts for traditional medicine for synergism. There could be more activity of the extracts as a result of the combination. The phytochemicals are responsible for the antibacterial activities of the extracts.

## CONCLUSION

In conclusion, the ethanolic extracts of the leaves of Lemon grass and Polyalthia Longifolia offer potential antibacterial property against *Staphylococcus aureus*.

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