

Comparative Study of Antimicrobial Potency and Phytochemical Analysis of Methanolic Extracts of the Leaf and Flower of *Luffa cylindrica*

Aladejimokun, A. O.¹, Adesina, I. A.^{1*}, Falusi, V. O.¹ and Edagbo, D. E.²

¹Department of Science Laboratory Technology, Faculty of Applied Sciences, Rufus Giwa Polytechnic, P.M.B. 1019, Owo, Ondo State, Nigeria

²PGR Unit, National Centre for Genetic Resources and Biotechnology, P.M.B. 5382, Ibadan, Oyo State, Nigeria

*E-mail of the Corresponding author: isaacadesina@gmail.com

Abstract

Leaf and flower methanolic extracts of *Luffa cylindrica* were investigated for antimicrobial activities and phytochemical constituents. The extracts were tested against four bacteria (*Escherichia coli*, *Klebsiella* spp., *Staphylococcus aureus*, and *Salmonella typhi*) and two fungal strains (*Aspergillus niger* and *Candida albicans*) by using the agar-well diffusion method while the phytochemical constituents were quantified using standard procedures. The result of the antimicrobial activity revealed that the methanolic leaf extract was more potent than that of the flower against bacterial strains used while methanolic flower extract exhibited a better antifungal activity against *Candida albicans* and *A. niger*. The phytochemicals analysed include alkaloid, tannin, saponin, phytate and oxalate which were quantitatively higher in flower extract than leaf extract. The methanolic extract of the leaves and flowers of *Luffa cylindrica* holds great promise for the development of effective drugs for the treatment of bacterial infections and more efficiently against *Candida albicans* infection.

Keywords: *Luffa cylindrica*, antimicrobial activity, phytochemical, agar-well diffusion, methanolic extract

1. Introduction

Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and ailments (Balakrishnan and Alka, 2013).

Luffa cylindrica is an important plant with medicinal properties. *L. cylindrica* commonly called sponge gourd, loofa, vegetable sponge, bath sponge or dish cloth gourd, is a member of Cucurbitaceae family (Sangh *et al.*, 2012). The fruits of *Luffa cylindrica* are smooth and cylindrical shaped. One mature *Luffa* sponge will produce at least 30 seeds (Sangh *et al.*, 2012). *L. cylindrica* has alternate and palmate leaves comprising petiole. The leaf is 13cm and 30cm in length and width respectively and has the acute-end lobe. It is hairless and has serrated edges. The flower of *L. cylindrica* is yellow and blooms on August – September. *L. cylindrica* is monoecious and the inflorescence of the male flower is a raceme and one female flower exists. Its fruit, a gourd, is green and has a large cylindrical shape and grows climbing on other physical solid materials (Oboh and Aluyor, 2009).

The leaves are used in amenorrhea, parasitic infections, skin diseases, inflammation and abscesses. Flowers are effective in migraine (Khare, 2007; Sutharshana, 2013). Little or no work has been done on the comparative antimicrobial efficacy of the leaves and flowers of *L. cylindrica*; this informed the choice of this research work. This study is aimed at comparing the antimicrobial potency and phytochemical constituents of the methanolic extracts of leaves and flowers of *L. cylindrica*.

2. Materials and Methods

2.1 Collection and Preparation of Samples

The fresh leaves and flowers of *Luffa cylindrica* used for this work were collected from Owo, Ondo State, Nigeria. The samples (leaves and flowers) were dried under shade to avoid possible breakdown of their active properties, segregated and pulverized by mechanical grinder, and then the powders were passed through a mesh sieve and packed into small containers labelled separately i.e *Luffa cylindrica* leaf powder and *Luffa cylindrica* flower powder.

2.2 Preparation of Extracts

The powdered samples were soaked in absolute methanol for 48 hours after which they were filtered using muslin cloth. The filtrate was then left to air dry. The crude extract gotten from the two samples (flowers and

leaves) were stored separately in clean bottles and tightly covered to avoid contamination.

2.3 Test Microorganisms

The extracts were tested against four intestinal bacterial isolates (*Escherichia coli*, *Klebsiella* spp., *Staphylococcus aureus*, *Salmonella typhi*) and two fungi strains (*Aspergillus niger* and *Candida albicans*). They were obtained from the Federal Medical Centre, Owo, Ondo State. The test microorganisms were maintained on nutrient agar (bacteria) and potato dextrose agar (fungi) slopes; and kept in refrigerator at 4°C.

2.4 Antimicrobial Activity Assay

Antimicrobial activities of the plant extracts were tested using agar-well diffusion method (Gandhiraja *et al.*, 2009). 0.1 ml of the overnight culture of the selected strains of bacteria was seeded into molten nutrient agar and potato dextrose agar for fungi using pour plate method. 5 wells were made on the agar surface with a 5 mm sterilized cork borer. The extracts were poured into the wells using sterile syringe. The plates were incubated at 37°C for 24 hours for bacteria and 48 hours for fungal activity. The plates were observed for the zone of inhibition around the wells. The zones of inhibition were recorded in millimetres excluding the diameter of the wells. Chloramphenicol and Gentamicin were used as standard antibiotic drug respectively.

The extracts were prepared by dissolving 0.5g, 1g, 1.5g, and 2g of the concentrates obtained from the solvent (methanol) and made up to 10 ml with distilled water to give a concentration of 0.05 g/ml, 0.1 g/ml, 0.15 g/ml, and 0.2 g/ml respectively (Owoseni and Ogunnusi, 2006; Oyetayo *et al.*, 2007).

2.5 Quantitative Phytochemical Analysis

The phytochemical screening for the quantity of secondary metabolites in *L. cylindrica* leaves and flowers methanolic extracts was performed using the methods described by Harborne (1998) and Sofowora (2008).

3.0 Results and Discussion

The antimicrobial activity of methanolic extracts of the leaves and flowers of *Luffa cylindrica* are shown in Table 1. The results which were expressed as the zone of inhibition (mm) of the indicator bacteria and fungi by the methanolic extracts. *Escherichia coli*, *Staphylococcus aureus*, *Aspergillus niger* and *Candida albicans* were susceptible to both leaf and flower methanolic extracts of *L. cylindrica*, with the exception of *Salmonella typhi* which was inhibited by only the methanolic leaf extract; while *Klebsiella* spp. was not susceptible to any of the extracts. All the susceptible organisms were sensitive at 0.10 g/ml, 0.15g/ml and 0.2 g/ml concentrations. *Staphylococcus aureus* and *Candida albicans* were the only organisms that were sensitive at 0.05 g/ml concentration which is the lowest concentration used in this study.

The methanolic extracts exhibited antimicrobial activity against the microorganisms tested as assessed by zones of inhibition that ranged from 2.0 to 20.0 mm. *Candida albicans* showed the highest susceptibility of 20 mm. From these results, it can be deduced that the methanolic leaf extract exhibited a better antibacterial activity against *E. coli*, *S. aureus*, and *S. typhi*, while methanolic flower extract exhibited a better antifungal activity against *C. albicans* and *A. niger*.

The phytochemical active compounds of methanolic extracts of *Luffa cylindrica* were quantitatively analyzed for leaf and flower separately and the results are presented in Table 2. The phytochemical contents of alkaloid, tannin, saponin, phytate and oxalate were found to be higher in flower than the leaf.

The medicinal value of plants lies in some chemical substances that have a definite physiological action on the human body. Different phytochemicals have been found to possess a wide range of activities, which may help in protection against chronic diseases (Mir *et al.*, 2013). Many medicinal plants are considered to be potential antimicrobial crude drugs as well as a source for novel compound with antimicrobial activity, with possibly new modes of action (Dhiman *et al.*, 2012).

The zones of inhibition of growth of the microorganisms used in this study are function of relative antimicrobial activity of the extracts. It has been reported by Oyetayo *et al.* (2007) that saponin and tannin are the major properties in medicinal plants that gives them their antimicrobial properties. The importance of alkaloids, saponins and tannins in various antibiotics used in treating common pathogenic strains has been reported by Kubmarawa *et al.* (2007).

4.0 Conclusion

It can be concluded that some methanol-extractable phytochemicals from leaf and flower of *Luffa cylindrica* possess in-vitro antimicrobial activity against the test microorganisms. The ability of the *L. cylindrica* methanolic extracts to inhibit the pathogens used as test microorganisms holds promise for potential application in the pharmaceutical industry as a source of useful drugs.

References

Balakrishnan, N. and Alka, S. (2013). Preliminary phytochemical and pharmacological activities of *Luffa cylindrica* L. fruit. *Asian Journal of Pharmaceutical and Clinical Research*, 6 (2), 113 – 116.

Dhiman, A., Nanda, A., Ahmad, S. and Narasimhan, B. (2012). *In vitro* antimicrobial status of methanolic extract of *Citrus sinensis* Linn. fruit peel. *Chronicles of Young Scientists*, 3 (3), 204 – 208.

Gandhiraja, N., Sriram, S., Meenaa, V., Kavitha, S. J., Sasikumar, C. and Rajeswari, R. (2009). Phytochemical screening and antimicrobial activity of the plant extracts of *Mimos pudica* L. against selected microbes. *Ethnobotanical Leaflets*, 13, 618 – 624.

Harborne, J. B. (1998). *Phytochemical method: A guide to modern technique of plant analysis*. 3rd Edition Chapman and Hall, New York, 1 – 198 pp.

Khare, C. P. (2007). *Indian medicinal plants: An illustrated dictionary*. Springer Science and Business Media, New York, USA, 384 – 385 pp.

Kubmarawa, D., Ajoku, G. A., Enworem, N. M. and Okorie, D. A. (2007). Roles of agricultural biotechnology in ensuring adequate food security in developing Societies. *African Journal of Biotechnology*, 6, 1690 – 1696.

Mir, M. A., Sawhney, S. S. and Jassal, M. M. S. (2013). Qualitative and quantitative analysis of phytochemicals of *Taraxacum officinale*. *Wudpecker Journal of Pharmacy and Pharmacology*, 2 (1), 1 – 5.

Oboh, I. O. and Aluyor, E. O. (2009). Importance of *Luffa cylindrica* in agriculture. *African Journal of Agricultural Research*, 8, 684 – 688.

Owoseni, A. A. and Ogunnusi, T. (2006): Antibacterial effects of three selected chewing stick extract on *Lactobacillus* spp. *International Journal of Tropical Medicine*, 3, 103 - 106.

Oyetayo, F. L., Oyetayo, V. O. and Ajewole, V. (2007). Phytochemical profile and antibacterial properties of the seed and leaf of the *Luffa* plant (*Luffa cylindrica*). *Journal of Pharmacology and Toxicology*, 2(6), 586 – 589.

Sangh, P., Kumar, A., Sharma, N. K. and Jha, K. K. (2012). *Luffa cylindrica*: An important medicinal plant. *Journal of Natural Product and Plant Resources*, 2(1), 127 – 134.

Sofowora, A. (2008). *Medicinal plants and traditional medicine in Africa*. Third Edition, Spectrum Books Limited, Ibadan, Nigeria, 199 – 202 pp.

Sutharshana, V. (2013). Protective role of *Luffa cylindrica*. *Journal of Pharmaceutical Sciences and Research*, 5(9), 184 – 186.

Table 1. Zone of inhibition (mm) of indicator microorganisms by methanolic extracts of *Luffa cylindrica* leaves and flowers

Extract (conc.)	Microorganisms											
	<i>E. coli</i>		<i>Klebsiella</i> spp.		<i>S. aureus</i>		<i>S. typhi</i>		<i>A. niger</i>		<i>C. albicans</i>	
	MLE	MFE	MLE	MFE	MLE	MFE	MLE	MFE	MLE	MFE	MLE	MFE
0.05 g/ml	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	8.0	10.0
0.10 g/ml	3.0	2.0	0.0	0.0	5.0	4.0	4.0	0.0	0.0	5.0	9.0	12.0
0.15 g/ml	4.0	4.0	0.0	0.0	6.0	5.0	5.0	0.0	4.0	6.0	10.0	15.0
0.2 g/ml	6.0	6.0	0.0	0.0	7.0	6.0	6.0	0.0	5.0	7.0	13.0	20.0
Chloram-phenicol	30.0	30.0	24.0	24.0	32.0	32.0	21.0	21.0	0.0	0.0	0.0	0.0
Gentamicin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20.0	27.0	27.0

Key:

MLE: Methanolic Leaf Extract

MFE: Methanolic Flower Extract

(0.0): No Zone of Inhibition

Table 2. Phytochemical analysis of methanolic extracts of the leaves and flowers of *Luffa cylindrica*

Phytochemicals	Methanolic Extracts	
	Leaf	Flower
Alkaloid (g/100g)	0.11	1.13
Tannin (mg/g)	84.9	238.8
Saponin (g/100g)	0.01	0.03
Phytate (g/100g)	2.02	2.93
Oxalate (mg/g)	2.43	4.68

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:

<http://www.iiste.org>

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

Recent conferences: <http://www.iiste.org/conference/>

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

