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Evaluation of anti-resistant activity of Auklandia (*Saussurea lappa*) root against some human pathogens

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PEER REVIEW

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Comments

This is an adequate pilot study in which the authors have evaluated the antimicrobial activity of *S. lappa* root against bacterial pathogenic strains. The results have demonstrated ethanolic root extract of *S. lappa* to be highly effective on six human bacterial stains. The paper has concentrated on the isolation, characterization and evaluation of antibacterial potentials of *S. lappa* root extracts. It also concentrated on some preliminary studies such as phytochemical screening potential of the extracts.

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ABSTRACT

Objective: The antimicrobial activity of the ethanol extract of the Auklandia (*Saussurea lappa*) root plant was investigated to verify its medicinal use in the treatment of microbial infections. **Methods:** The antimicrobial activity of the ethanol extract was tested against clinical isolates of some multidrug-resistant bacteria using the agar well diffusion method. Commercial antibiotics were used as positive reference standards to determine the sensitivity of the clinical isolates. **Results:** The extracts showed significant inhibitory activity against clinical isolates of methicillin resistant *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, *Extended Spectrum Beta-Lactamase*, *Acinetobacter baumannii*. The minimum inhibitory concentration values obtained using the agar dilution test ranged from 2.0 µg/µL–12.0 µg/µL. In the contrary the water extract showed no activity at all against the tested isolates. Furthermore, the results obtained by examining anti-resistant activity of the plant ethanolic extract showed that at higher concentration of the plant extract (12 µg) all tested bacteria isolates were inhibited with variable inhibition zones similar to those obtained when we applied lower extract concentration using the well diffusion assay. **Conclusion:** The results demonstrated that the crude ethanolic extract of the Auklandia (*Saussurea lappa*) root plant has a wide spectrum of activity suggesting that it may be useful in the treatment of infections caused by the above clinical isolates (human pathogens).

KEYWORDS

Auklandia, *Saussurea lappa*, Ethanol extract, Antimicrobial activity, Anti-resistant activity, Minimum inhibitory concentration (MIC)

1. Introduction

Plant-derived drugs remain an important resource, especially in developing countries, to combat serious diseases. Approximately 60–80% of the world's population still relying on traditional medicines for the treatment of common illnesses^[1–4]. There are about 60–90% of patients

with arthritis who have used complementary and alternative medicine; most used traditional Chinese medicine^[5]. The use of medicinal plants as a source for relief from illness can be traced back over five millennia to the written documents of the early civilization in China, India and the Near east, but it is doubtless an art as old as mankind^[6].

Although, the potential of higher plants as source for new

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drugs is still largely unexplored. Over the past decades, there has been increasing interest in the investigation of the natural products from different sources particularly from higher plants for the discovery of new antimicrobial and antioxidant agents, such as tannins, terpenoids, alkaloids, and flavonoids, which have been demonstrated to have *in vitro* antimicrobial properties[7–10]. As this may give a new source of antimicrobial agents, many research groups that are now engaged in medicinal plants research have given much attention to these natural resources.

The activities have been selected because of their great medicinal relevance and emergence of antibiotic resistance. Within the recent years, infections have increased to a great extent and resistance against antibiotics becomes an ever-increasing therapeutic problem[11]. Antibiotics are often used against diseases caused by *Klebsiella* spp and other human pathogens including methicillin-resistant *Staphylococcus aureus*(MRSA), *Acinetobacter baumannii*(*A. baumannii*), *Pseudomonas aeruginosa*(*P. aeruginosa*), *Escherichia coli*(*E. coli*) and *Extended Spectrum Beta-Lactemase*(*ESBL*), bacteria. However, these pathogens are becoming increasingly antibiotic resistant, so that many are now labeled as multidrug-resistant[12]. Thus, it is an important task for the researcher to find out alternative agent.

Currently, there are few or no antibiotics available or likely to be available soon to treat life-threatening infections caused by some of these bacteria. For example, *Acinetobacter baumannii* has caused outbreaks of infections in intensive-care units[13]. This is because bacteria resistant to “last-line” antibiotics, such as carbapenems (*e.g.*, meropenem), glycopeptides (*e.g.*, vancomycin), fluoroquinolones (*e.g.*, ciprofloxacin).

Medicinal plant can be very effective as a candidate for treating urinary tract infections and typhoid fever[14]. So that plants predicated antimicrobials provide a vast untapped source for medicines and further exploration of plant antimicrobials needs to occur.

Thus, herbal medicine can be the future promise candidate that provides adequate solution for effective treatment of diseases caused by bacteria. The efficacy of herbal *Aucklandia* (*Costus*) (*Saussurea lappa*) (*S. lappa*) root extract over the multidrug resistant bacteria isolates has been investigated in the present study. Apart from antimicrobial activities, *S. lappa* root extracts are also exploited for therapeutic purpose to cure several disorders. The crude extract of the *S. lappa* root was found to inhibit the severity of diarrhea induced by some of the investigated bacteria strains[15,16]. It is speculated that the extract was able to inhibit electrolyte permeability in the intestine due to castoroiland/or through the inhibition of prostaglandins release.

The main aim of this study was to investigate the antimicrobial activity of *S. lappa* root plant(Figure 1). The herb is well known by many traditional healers to be used as a traditional remedy for many diseases. Such uses are for diarrhea and dysentery-like disorders, or for abdominal pain

and tenesmus. The current investigation was based on the evaluation of such traditional herb on its antibacterial activity against human pathogenic multidrug resistant bacteria.



Figure 1. The *Aucklandia*–(*Costus* also known as *S. lappa*) root.

2. Materials and methods

2.1 Plant materials

One thousand gram of *Costus* (*S. lappa*) root was purchased from Alseeb, General Herbal Market, Muscat, Oman. The plant root was identified at the Pharmacognosy Department, Faculty of Pharmacy, Sana'a University. Part of the identification of the investigated plants was done by Dr. A. Wadieh, Department of Botany, Naser College, in Lahj Governorate, University of Aden, Republic of Yemen. Voucher specimens were deposited at the Pharmacognosy Department, Faculty of Medicine, University of Science and Technology, Sana'a, Republic of Yemen.

2.2 Extraction of plant material

2.2.1 Ethanol extract

The method of extraction using ethanol was followed as stated by Randhir *et al.*(2004). Two hundred and fifty grams of ground samples were soaked in 400 mL of 99.9% ethanol and homogenized in an electric blender for approximately 5 min and incubated at room temperature for 4 d. The mixture was then filtered twice using vacuum and then the solvent (ethanol) was allowed to evaporate at room temperature and then re-extracted with 250 mL of 99.9% ethanol by using a shaking water-bath at 70 °C for 6 h. The mixture was then filtered and ethanol was allowed to evaporate at room temperature. The residue (extract) was collected and kept at 4 °C.

2.2.2 Water extract

To obtain a water extract of *S. lappa* root, ethanol

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