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Natural Antimicrobials and Antidiabetic Plant Extracts, Singly and in Combination, Potential Source of Novel Antimicrobials and Hypoglycemic Agents

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Abstract

Research in the design and synthesis of antimicrobials must be continued on this planet, considering that bacteria develop antimicrobial resistance to antimicrobial drugs. In addition, many synthetic drugs have side effects when administered and the cost of synthesizing drugs is an expensive endeavor and is non realized in developing country like Guyana. Guyana, however, vast and diverse flora have been shown to possess potent and selective antimicrobial activity that can lead to the further development of herbal medicines with new applications. In addition, our plants have been shown to possess striking hypoglycemic effect in guinea pig model experiments. Further research is necessary to continue with the development of novel herbal medicines, singly or in combination. In addition, the isolation and purification of the known and unknown active natural products that may be responsible for the medicinal activity, singly or in combination. In addition, a modulation of their structure/activity relationship. Unknown natural products would form the basis of novel drug discovery

Keywords: Antimicrobials; Hypoglycaemic Agents; Guyana; Flora; Novel Drug Discovery.

Introduction

Research in the design and synthesis of antimicrobials will continue to be problematic on our planet, considering that bacteria and fungi develop resistance to antimicrobials over a period of time [1-5] . This results from indiscriminate use of commercial antimicrobial drugs for the treatment of infectious diseases and the current global antibiotic resistance. Many synthetic drugs have several adverse side effects which are usually irreversible when administered and the cost of synthesizing drugs in most cases is an expensive endeavor [1-5] and is non-realistic for a developing country like Guyana. Plants have a long therapeutic history over thousands of years and still considered to be promising source of medicine in the traditional health care system [6]. Plants also have a wide variety of secondary metabolites some of which are antimicrobial [7-9]. Crude plants extracts have also demonstrated antimicrobial activity [10-12].

Guyana flora is richly bio diversified and it's organic and aqueous extracts have been shown to possess potent and selective antimicrobial activity to date, compared with standard antibiotics: penicillin, nystatin and ampicillin [13-17]. Also, recently antidiabetic activities [18]. With the view of avoiding clinical trials, an expensive endeavor for a Third World country, we have shown that Guyana's flora has strong potent antibacterial and antifungal activity. We have over the years, investigated the antimicrobial activity and selectivity of a wide range of plants and fruits against human pathogens such as *E. coli*, *S. aureus*, *Bacillus subtilis*, *K. pneumonia, P. aeruginosa* and *C. albicans*. Extracts include those from *Brassica rapa chinensis, Artocarpus altilis*, *Solanum melongena* fruits, leaves of *Moringa oleifera* [19], passion fruit (*Passiflora edulis*) [20], *Phyllanthus acidus, Sphagneticola trilobata* and *Doliocarpus dentatus's* [21] bark amongst others. Antimicrobial potency and selectivity have been comparable to standard antimicrobials such as penicillin and nystatin. against pathogens. Also, the antimicrobial potency and selectivity can be modulated in the presence and absence of transition metal salts such as zinc and copper. For example, a study to investigate the Antimicrobial Activity of the Uncombined and Combined Aqueous Extract of *Phyllanthus acidus*, *Sphagneticola trilobata* Leaves and *Doliocarpus dentatus* Bark against Selective Pathogenic microorganisms in the absence and presence of Zn2+ cations revealed that the highest AZOI of 165.05 mm2 was induced by *P. acidus* extract against *E. coli.*

In the absence of Zn2+, zero AZOI was observed for the combined extract of *P. acidus* + *S. trilobata*, *S. trilobata* + *D. dentatus* and *P. acidus* + *D. dentatus* against *S. aureus* and *K. pneumoniae*. The combined plant extract, without Zn2+, seems to induce a higher AZOI against *E. coli*, *K. pneumoniae*, *C. albicans* and *P. aeruginosa* in comparison with the individual plant extract. As an example, the combined plant extract of *S. trilobata* and *D. dentatus* induces AZOI of 122.66 mm2, whereas *S. trilobata* induces AZOI of

117.79 mm2. For the combined plant extract with Zn2+, a lower AZOI was induced, compared with the individual plant extract. Selective antimicrobial activity were observed for the uncombined and combined extracts, with and without Zn2+ against some of the pathogens. For example, *P. acidus* aqueous extract showed AZOI of 165.1 mm2 against *E. coli*, whereas *S. trilobata* showed AZOI of 67.17 mm2 against *E. coli* i.e., a selectivity ratio of 2.5 vs *E.coli* with respect to the above two extracts.

Antimicrobial activities of plant extracts at varying concentrations of 0.025g/ml, 0.05g/ml and 0.1g/ml have been investigated mainly using the Disc Diffusion Assay. Here the diameter and the computed Area of Zone of Inhibition have been used as a gauge of the plant's antimicrobial activity. For example, AZOI of 209.34 mm2 was induced by the CH3CH2OH extract of *Brassica rapa chinensis* against *E. coli* at a concentration of 0.025g/ml whereas an AZOI of 12.56 mm2 was induced by *Brassica rapa chinensis* against *Bacillus subtilis* at a concentration of 0.025g/ml. Antidiabetic experiments using plant extracts have been conducted using guinea pigs model experiments.

Conclusion

Plant extracts have indeed shown to possess potent and selective antimicrobial activity against human pathogens. Also, striking hypoglycemic effect. Research should continue in the development of herbal medicines to combat current and new ailments. Also, an isolation of the active principle or natural products on route to novel drug discovery.

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