

Plant Extracts as An Alternative to Synthetic Medicines

Jagessar RC*

Faculty of Natural Sciences, University of Guyana

*Corresponding author: Jagessar RC, Department of Chemistry, Faculty of Natural Sciences, University of Guyana

Received: 📅 January 09, 2020

Published: 📅 January 27, 2020

Abstract

Mankind first medicines were extracts from plants. However, over the years, mankind has resorted to the use of synthetic medicines. Whilst, synthetic medicines have fulfilled their roles and save millions of people around the globe, there is still a need to promote the use of herbal medicines, considering that synthetic medicines have severe side effects when administered and the cost of synthesising drugs, is an expensive endeavors for developing countries like Guyana. Guyana has an adundant of diverse flora, whose extracts have been shown by us and others to have potent and selective antimicrobial activities and antidiabetic activities. However, there is a need to promote the isolation of antimicrobial, antidiabetic and anti-cancer drugs from plants, an elucidation of their structure and modulation of their medicinal activities. This entails significant finance to aid in the purchase of requisite equipment etc. in Novel Drug Discovery. The Guyanese Diaspora and the Entrepreneurship Sector can promote such research in Guyana via the provision of finance to purchase "State of the Art" equipment to conduct such research or the establishment of a National Herbal Research Institute. Such an institute will promote further research on our current herbal medicines and also on the discovery of new Herbal medications.

Keywords: Medicines antimicrobial activities Antidiabetic activities Anti-cancer activities Diaspora Entrepreneurship

Introduction

Mankind first medicines were extracts from plants. Plants have had a long history in modern medicine [1-18]. For example, long before the advent of modern medicine, the Peruvians were fending off malaria with the Cinchona bark from the "quinaquinas" tree. It was given as a cure to a Spanish countess who fell ill with the disease in Lima in around 1630. Then Bernabe Cobo, a Spanish missionary and naturalist was the first to bring the bark to Europe. Quinine was purified from the bark by a team of French pharmacists¹⁹. Over the years, mankind has resorted to the use of synthetic medicines. Whilst, synthetic medicines have fulfilled their roles and save millions of people around the globe, there is still a need to promote the use of herbal medicines, considering that synthetic medicines have severe side effects when administered and the cost of synthesising drugs, is an expensive endeavours for developing countries like Guyana.

Antimicrobial endeavours

Guyana, has an adundance of diverse flora, whose extracts have been shown by us and others to have potent and selective antimicrobial activities against human pathogens such as *E.coli*, *S.aureus*, *K. pneumoniae*, *B. subtilis* and *Candida albicans*. We have

also shown that selected plant extracts exhibited antidiabetic activities. Our initial efforts to evaluate the antimicrobial properties of plant extracts focuses on the leaves and stem extracts of plants. These were inclusive of those of *Samanea Saman*, *Smilax schomburgkiana*, *Mormordica charantia*, *Phyllanthus Acidus*, *Sphagneticola Trilobata* and *Dolioscarpus Dentatus* [10-15]. Later on, we focused our antimicrobial studies of fruits. The idea is that a fruit is edible and so an evaluation of its antimicrobial properties, singly and in combination, would eventually lead us to find some good natural antimicrobials, without the need for clinical trials. In all our studies on antimicrobial activity of leaves, stems and fruit extracts, the diameter of Zone of Inhibition, DZOI and the Area of Zone of Inhibition, AZOI were used as guage of antimicrobial studies. Amongst the fruits investigated were passion fruit (*passiflora edulis*), *Vicia faba L* [16-20]. In search for natural antimicrobials, our aim is to find leaves, stems and fruit extracts that would be selective and potent as synthetic antimicrobials such as penicillin, aminoglycosides, and tetracyclines etc.

Antidiabetic endeavour

Diabetes mellitus is a chronic health problem around the world and in Guyana with long term consequences that are potentially

preventable. It is a heterogeneous group of disease, characterized by high blood glucose levels resulting from impaired insulin secretion, impaired insulin action, or both [20-27]. In a hyperglycemic state, the body tries to remove excess glucose by excreting in the urine. This increases urine output, causing glycosuria and result in frequent thirst. In addition, the body is deprived of glucose energy and seeks alternative energy sources such as fats and muscle tissues, leading to weight loss [23]. A diminishing growth effect and increased predisposition to certain infections, may also be present with chronic hyperglycemia⁴. These combinations along with polyuria, polydipsia, polyphagia, and blurry vision produces the common symptoms of diabetes [24]. As this disease progresses, vascular damage ensues leading to severe diabetic microvascular and macrovascular complications [25]. Therefore, diabetes covers a wide range of diseases which are the major causes of chronic morbidity and death in diabetic subjects [26,27].

Selected plants are a potential complementary source of hypoglycemic drugs to combat diabetes, in addition to the use of synthetic drugs: insulin, metformin etc. We have shown that the aqueous extract of the fruits of *Psidium guajava*, *Averrhoa bilimbi* and the peel of *Tamarindus indica* exhibited hypoglycemic effect on normoglycemic guinea pigs. Administration of extracts of *Psidium guajava*, *Tamarindus indica* and *Averrhoa bilimbi* resulted in a marked hypoglycemic (reduction) activity in blood glucose levels when compared to the control and Glibenclamide treated group on the 12th day: *Psidium guajava* (90 ± 3.0 to 75.7 ± 3.5 mg/dL), *Tamarindus indica* (89.0 ± 5.6 to 70.7 ± 2.1 mg/dL) and *Averrhoa bilimbi* (110.0 ± 9.2 to 86.7 ± 10.0 mg/dL). Glibenclamide also resulted in a reduction (88.0 ± 2.0 to 67.3 ± 3.5 mg/dL) as compared to the control [28].

Antidiabetic effect of the ethanolic extract of *Phyllanthus emblica* fruits in evan rats has been reported and is dose dependent [29]. The anti-hyperglycemic effect of Quercetin, a major constituent of the methanolic extracts of *Phyllanthus emblica* fruit in Streptozotocin (STZ) induced diabetic rats were determined [30]. There are several herbs that are used to treat diabetes in Guyana and internationally [31-35]. Locally *Momordica charantia* [30], an herbaceous, tendril-bearing vine contains a compound called charantin, which have hypoglycaemic effect. It has been found to increase insulin sensitivity. A daily dose of 100mg per kilogram of body weight is comparable to 2.5mg/kg of the anti-diabetes drug glibenclamide taken twice per day. Other compounds in *M. charantia* have been found to activate the AMPK, the protein that regulates glucose uptake. The whole plant is used as a decoction for diabetes. The dry leaf and stem are boiled, and the water drunk as an anti-diabetic. The fruit is cooked and eaten as an anti-diabetic. Use with almond oil for a vulnerary. Tablets of *M. charantia* extract are sold in the United Kingdom.

Phyllanthus niruri [31] contains alkaloids, flavonoids and triterpenes. The whole plant is used as a blood purifier (bitter tonic)

to reduce blood sugar level. It's available as capsules. *Cajanus cajan* [30]. Pigeon peas contain high levels of protein and the important amino acids methionine, lysine, and tryptophan. Leaves and flowers are boiled for a diuretic and diabetes remedy. The whole plant of *Desmodium barbatum* [30] is use to reduced blood sugar level. The wood of the plant, Telitoxium [27]. is used for diabetes. The active adaptogenic constituents of *Tinospora cordifolia* [30] are diterpenoid compounds: polyphenols, and polysaccharides, including arabinogalactan polysaccharide. *T. crispa* and *T. rumphii* are used in Thailand and Philippines for treatment of diabetes. A decoction of the leaves of *Azadirachta indica* [30], Neem is used as a bitter tonic for treating diabetes and jaundice. Internationally, the juiceof the leaves of *Abrus precatorius* [31-34] are given to diabetic patients. *Achyranthes aspera* [32-34] is used as a decoction in the treatment of diabetes mellitus. Likewise, the roots of *Catharanthus roseus* is used as decoction in the treatment of diabetes mellitus. The entire plant of *Centella asiatica* [32-34] is also used as a decoction in the treatment of diabetes mellitus. [32-34] *Curcuma longa* is a rhizomatous herbaceous perennial plant which is used in the treatment of diabetes mellitus. *Phyllanthus emblica* [32-34]. Edible fruits are antidiabetic in nature. *Piper bettle* [32-34] lea extract is used in the treatment for diabetes mellitus. *Sphaeranthus indicus* [29-31].

Anticancer endeavours

Table 1: Some selected anticancer plants and their active constituents.

Plant Botanical Name	Family	Active Constituents
<i>Allium sativum</i>	<i>Liliaceae</i>	Alliin, allicin alliin, alliinase
<i>Ananas cosmosus</i>	<i>Bromeliaceae</i>	Bromelain
<i>Annona species</i>	<i>Annonaceae</i>	Acetogenins
<i>Betula utilis</i>	<i>Betulaceae</i>	Betulin
<i>Catharanthus roseus</i>	<i>Apocynaceae</i>	Vinblastine, Vincristine
<i>Echinacea augustifolia</i>	<i>Asteraceae</i>	Arabinogalactan
<i>Ginkgo biloba</i>	<i>Ginkgoaceae</i>	Ginkgolide-B, A, C and J
<i>Glycine max</i>	<i>Leguminosae</i>	Zinc, selenium, vitamins
<i>Glycyrrhiza glabra</i>	<i>Leguminosae</i>	Glycyrrhizin
<i>Lentinus edodes</i>	<i>Agaricariaceae</i>	Lentinan
<i>Ochrosia elliptica</i>	<i>Apocynaceae</i>	Ellipticine and 9-methoxy ellipticine
<i>Panax ginseng</i>	<i>Araliaceae</i>	Ginsenosides, Panaxosides
<i>Taxus brevifolia</i>	<i>Taxaceae</i>	Taxanes, taxol, cepholomannine
<i>Withania somnifera</i>	<i>Solanaceae</i>	Withanolides, Withaferin

While plants have been tested over the years for their anticancer activities abroad and proven positive, such research is lacking in Guyana. There is a need to screen plants in Guyana for their anticancer activities. This stems from the fact that cancer is on the rise in Guyana. Cancer has been a constant battle globally with a lot of development in cures and preventative therapies. Cancer is the uncontrolled growth in human cells and will result in the formation of tumours of malignant cells with the potential to be metastatic³⁵. Treatments include chemotherapy, radiotherapy and the use of synthetic drugs such as *cis-platin*. Using chemotherapy can put patients under a lot of strain and further damage their health. Thus, there is a need for an alternative complementary medicine in herbal treatments³⁶. However, this research is hampered by the lack of cancer research equipment. There needs to be the establishment of a cancer research unit in Guyana, to assess the anticancer proficiency of plants. (Table 1). shows a list of plants tested abroad for their anticancer proficiency [37-45].

Diaspora role in promoting herbal medicines in Guyana

However, there is a need to promote the isolation of antimicrobial, antidiabetic and anti-cancer drugs from plants, an elucidation of their structure and modulation of their medicinal activities. Also, an investigation of their activities. This entails significant finance to aid in the purchase of requisite equipment etc in Novel Drug Discovery. A separate research laboratory, with modern equipment and instrumentation is necessary at the University of Guyana to realize the above. Also, lacking in Guyana is the equipment to conduct anticancer and antiviral studies. A step can be taken further by the Government in the establishment of a National Herbal Research Institute to further explore our herbal folklore medicines and undiscovered herbal medicines. Such an institute will promote further research on our current folklore or traditional herbal medicines and also on the discovery of new Herbal medications. The Guyanese Diaspora, Entrepreneurship Sector and Foreign investors can promote such research in Guyana via the provision of finance to purchase "State of the Art" equipment to conduct such research. Our whole objectives is that we can be a leading exporter of herbal medicines in the Caribbean and one of the best in the world. Guyana has a rich biodiversity flora, whose herbal proficiency needs to be further investigated.

References

- Wilms LR (2009) Guide to Drugs in Canada. 114-117.
- Macor JE (2010) Annual reports in Medicinal Chemistry. Elsevier Inc 45: 295-311.
- Wood A (2008) Topics in Drug design and discovery. Elsevier Inc 41: 353-409.
- Bonner J (2009) Filling the Antibiotic Gap. 6(8):16.
- Kelland K (2013) Antibiotic Resistance Poses Catastrophic Threat to Medicine. P: 1-3.
- Shahid W, Durrani R, Iram S, Durrani M, Khan F (2013) Antibacterial activity *in Vitro* of medicinal plants, Sky Journal of Microbiology Research 1(2): 5-21.
- Rijo P, Faustino C, Simoes MF (2013) Antimicrobial natural products from *Plectranthus* plants Microbial pathogens and strategies for combating them: science, technology and education 922-931.
- Arif T, Bhosale JD, Kumar N, Mandal TK (2009) Natural Products-antifungal agents derived from plants. Journal of Asian Natural Products Research 11(7): 621-638.
- Melgarejo M, Mollinedo P, Castro JV (2006) Antibacterial activity of four Natural Products from a Bolivian Highland Plant *Revista Boliviana De Quimica*. 23(1): 40-43.
- Jagessar RC, Mohamed N (2010) Antimicrobial activity of selected plants extracts from Guyana's flora. Journal of Pure and Applied Microbiology 4(2): 533-540.
- Jagessar RC, Allen R (2011) Antimicrobial Potency of the Aqueous Extract of leaves of *Terminalia catappa*. Academic Research International 1(3): 362-371.
- Jagessar RC, Mars A, Gomathigayam (2011) Selective Antimicrobial properties of Leaf extract of *Samanea Saman* against *Candida albicans*, *Staphylococcus aureus* and *Escherichia coli* using several microbial techniques. Journal of American Science 7(3): 108-119.
- Jagessar RC, Mars A, Gomes G (2009) Leaf extract of *Smilax schomburgkiana* exhibit selective antimicrobial properties against pathogenic microorganisms. Life Science Journal 6(1): 76-83.
- Jagessar RC, Mohammed A, Gomes G (2008) An evaluation of the antibacterial and antifungal activity of leaf extracts of *Momordica Charantia* against *Candida albicans* *Staphylococcus aureus* and *Escherichia Coli*. Nature and Science 6(1):1-14.
- Jagessar RC, Hope S, (2016) 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. World Journal of Pharmacy and Pharmaceutical Sciences 5(8): 58-71.
- Jagessar RC, Ramchartar N, Spencer O (2015) A Review of the Antimicrobial Activity of Various Solvent Type extracts from Fruits and Edible Plants, in Fruit and Pomace Extracts: Biological Activity Potential Applications and Beneficial Health Effects. Nova Science Publisher.
- Jagessar RC, Hafeez, Chichester, Crepaul Y (2017) Antimicrobial Activity of the Ethanolic and Aqueous Extract of Passion Fruit *Passiflora edulis* Sims, in the absence and presence of Zn(OAc)₂·2H₂O. World Journal of Pharmacy and Pharmaceutical Sciences 6(9): 230-246.
- Jagessar RC, Hope S, Issacs S, Crepaul S, (2017) Antimicrobial Activity of the Ethanolic and Aqueous Extract of *Vicia faba* L. (Fabaceae) at three different concentrations in the absence and presence of Zn(OAc)₂·2H₂O. J Pharm Sci Therap 2(1):140-155.
- Hayley Bennett (2018) Chemistry World. 15(9):22-27.
- Holleman Frits (2014) Introduction to diabetes mellitus.
- Poretzky L (2002) Principles of diabetes mellitus. Boston Kluwer Academic.
- Diabetes Mellitus.
- Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 27(Suppl1): 62-69.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, et al. (2002) Molecular Biology of the Cell 4th edition. Garland Science.
- Hackett E, Jacques N (2009) Clinical Pharmacist 1: 475-478.
- Cade W (2008) Diabetes-Related Microvascular and Macrovascular Diseases in the Physical Therapy Setting. Physical Therapy 88(11): 1322-1335.
- (2004) Standards of Medical Care in Diabetes. Diabetes Care 27(suppl 1): 15-35.

28. Jagessar RC, Rodrigues A, Prasad K, Husain A, Kanhai V, et al. (2018) An investigation of the hypoglycemic effect of the aqueous extract of the fruits of *Psidum Guajava*, *Averrhoa Bilimbi* and the peel of *Tamarindus indica* in Normoglycemic guinea pigs. *J Pharm Drug Deliv Res* 7(4): 77-101.
29. Sultana Z, Jami S, Ali E, Begum M, Haque M (2014) *Pharmacology & Pharmacy* 5: 11-18.
30. Srinivasan P, Vijayakumar S, Kothandaraman S, Palani M (2018) *Journal of Pharmaceutical Analysis* 8: 109-118.
31. Kokwaro JO (2009) *Medical Plants of the Guianas (Guyana, Surinam, French Guiana)* pp: 94-189.
32. Lachman-White DA (1992) *A guide to the medicinal plants of coastal Guyana*. London: Commonwealth Secretariat, London, p: 26.
33. Ediriweera, ERHSS (2009) *A Review on Herbs Used in Treatment of Diabetes Mellitus by Sri Lankan Ayurvedic and Traditional Physicians*.
34. Grimes M (2010) *Herbs Help Treat Diabetes: Bilberry, Gymnema, Ginkgo and Salt Bush*.
35. Modak PDM (2007) *Indian Herbs and Herbal Drugs Used for the Treatment of Diabetes*. *J clin Biochem Nutr* 40(3): 163-173.
36. Khazir J, Mir BA, Pilcher L, Riley DL (2014) *Role of plants in anticancer drug discovery*. 7: 173-181.
37. What is cancer.
38. Itokawa H, Morit, H, Sumitomo T, Totsuka N, Takeya K (1987) Antitumour principles from *Alpinia galangal*. *Plant Med* 53(1): 32-33.
39. Roberts M (1990) *Indigenous Healing Herb*. pp: 1-285.
40. Van Wyk, BE, Van Oudtshoorn, B, Gercke, N (1997) *Medicinal Plants of South Africa*. pp: 1-304.
41. Caragay AB (1992) *Cancer-preventative foods and ingredients*. *Food Technology* 46: 65-68.
42. Steinmetz KA, Potter JD (1991) *Vegetables, fruits and cancer, Epidemiology*. *Cancer Causes Control* 1991 2(5):325-357.
43. Faried A, Kurnia D, Faried LS, Usman N, Miyazaki T, et al. (2007) *Anticancer effects of gallic acid isolated from Indonesian herbal medicine, Phaleria macrocarpa (Scheff.) Boerl. On human cancer cell lines*. *Int J Oncol* 30(3): 605-613.
44. Eberhsrdt MV, Lee CY, Lui RH (2000) *Antioxidant activity of fresh apples*. *Nature* 405(6789): 903-904.
45. ZschokeS, Rabe T, Taylor LS, Jager AK, Van Staden (2000) *J Plant part substitution-a way to conserve endangered medicinal plants*. *J Ethnopharmacol* 71(1-2): 281-292.
46. Wang CZ (2006) *Steamed American Ginseng berry Ginsenoside analysis and anticancer activities*. *JA gric Food Chem* 54: 9936-9942.



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: [Submit Article](#)

DOI: 10.32474/DDIPIJ.2020.03.000163



Drug Designing & Intellectual

Properties International Journal

Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles