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Ethnopharmacological communication

Anti-diabetic potential of selected ethno-medicinal plants of north east India

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ABSTRACT

Ethnopharmacological relevance: Through one-to-one interaction with the traditional healers, the present study has identified 15 medicinal plant species traditionally used as remedies to control diabetes.
Materials and methods: The methanolic extracts were screened for their α-glucosidase inhibitory activity. Hypoglycemic activity was assessed following glucose, sucrose and starch tolerance test on normal and STZ induced diabetic rats.
Results: Ficus cunia extract had the highest α-glucosidase inhibitory potency with IC_{50} 1.39 ± 0.74 μg mL^{-1} followed by *Schima wallichi* (IC_{50} 1.43 ± 0.20 μg mL^{-1}) and *Wendlandia glabrata* (IC_{50} 1.67 ± 0.33 μg mL^{-1}). In STZ induced diabetic rat model, *F. cunia* and *W glabrata* extracts reduced blood glucose concentration to near normal up to 14 days when administered 48 h after STZ.
Conclusion: The present study supports the traditional use of some of these medicinal plants in anti-diabetic remedies. The present study contributes to evidence for use of traditional medicine.

1. Introduction

The intrinsic utility of traditional medicine must be promoted for global acceptance and benefit of mankind. The scientific evaluation and validation of traditional medicines is imperative to open other avenues for the development of alternative drugs and therapeutic strategies. In continuation of our search for plant based anti-diabetic therapeutic agents, we have conducted an extensive survey and one-to-one interaction with traditional healers having significant expertise in the treatment of diabetes. Diabetes Mellitus is a metabolic disorder which has shocking impact on human and economic losses. According to international diabetes federation (IDF), 382 million people worldwide have diabetes and the prediction is that by 2035 the number will be almost 600 million (Zimmet et al., 2014). More than 90% people live with Type 2 diabetes mellitus or T2DM. Recently significant attention has been paid towards the use of natural health products as complementary or alternative approaches and efforts have been made for the development of anti-diabetic molecules from natural sources (Rachel et al., 2013; Mukherjee et al., 2006). The following 15 plant species which are mainly used by the *Maiba-Maibi* (traditional male and female healers) in their diabetes treatment remedies were selected for the present study.

2. Plant summary

2.1. *Antidesma diandrum Retz*

Antidesma diandrum Retz (Euphorbiaceae) is a shrub. In India, especially in the north east India the *Meitei* community use the boiled extract of leaf for treatment of diabetes (Devi et al., 2011).

2.2. *Meitei and meitei-pangal*

Meitei and *meitei-pangal* communities of north east India use the boiled extract of leaf of *Ardisia colorata* Roxb. (Myrsinaceae) for treatment of diabetes (Khan and Yadava, 2010).

2.3. *Artemisia maritima Linn*

Artemisia maritima Linn (Asteraceae) is a shrub with stout. The fresh extract of the leaves has traditionally been used for the treatment of diabetes (Khan and Yadava, 2010).

Abbreviations: DM, diabetes Mellitus; DMSO, dimethylsulfoxide; PNPG, *p*-nitrophenyl-α-D-glucopyranoside; STZ, streptozotocin; WHO, world health organization; IDF, international diabetes federation; FC, *Ficus cunia*; WG, *Wendlandia glabrata*; SRL, Sisco Research Laboratory

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2.4. *Curcuma angustifolia Roxb.*

Curcuma angustifolia Roxb. (Zingiberaceae) is well known for its use in ethnomedicine as demulcent, antipyretic and blood coagulant (Tushar et al., 2010). During our survey it was found that the boiled water extract of rhizome is used for the treatment of diabetes.

2.5. *Cyperus esculentus Linn*

Cyperus esculentus Linn (Cyperaceae) is an annual or perennial plant, used in ayurvedic medicine. In the north east India, mainly the *Meitei-pangal* community use the boiled extract of tuber to treat diabetic patients (Khan and Yadava, 2010).

2.6. *Euryale ferox Salisb*

Euryale ferox Salisb (Nymphaeaceae) is commonly found in the lakes, ponds and ditches. The tender leaves, petioles, fruits and seeds are consumed directly in the treatment of diabetes. Presence of phytosterols in the dietary component helps in lowering plasma, total and LDL cholesterol and is associated with its medical applications as a proteinuria inhibitor of diabetic nephropathy (Singh and Singh, 2011).

2.7. *Ficus cunia Ham. ex Roxb.*

The fruits of *Ficus cunia* Ham. ex Roxb. (Moraceae) are reported for different ethnobotanical uses (Lalfakjuala et al., 2007). During our survey it was observed that fruits were recommended to be consumed directly for the treatment of diabetes

2.8. *Kaempferia rotunda Linn.*

Kaempferia rotunda Linn. (Zingiberaceae) has perennial rhizomes that contain economically important phytochemicals. It is reported to have different medicinal values like anthelmintic activity (Agrawal et al., 2011). During our survey, the boiled extract of rhizome was found to be used for the treatment of diabetic patients.

2.9. *Leucaena leucocephala*

Leucaena leucocephala (Lam.) de Wit. (Fabaceae) represents the most widely used forage tree legume. The decoction of leaf has been used for the treatment of diabetes mainly by the *Meitei* and *Meitei-Pangal* communities (Khan and Yadava, 2010).

2.10. *Litsea monopetala*

Litsea monopetala (Roxb.) Pers. (Lauraceae) is a small tree. The anti-hyperglycemic activity of methanolic extract of leaves was evaluated through oral glucose tolerance tests (Hasan et al., 2014). The tender leaves are directly consumed in the traditional treatment of diabetes.

2.11. *Lysimachia obovata*

Lysimachia obovata Z.D.H. (Primulaceae) is a herb used as traditional herbal medicine for the treatment of diabetes (Devi et al., 2011).

2.12. *Pentaneura khasiana*

Pentaneura khasiana Kurz. (Asclepiadaceae) is a creeper. During our survey it has been found that most traditional healers use the fresh bark extract for the treatment of diabetes.

2.13. *Quercus serrata*

Quercus serrata Murray (Fagaceae) has different ethnobotanical values (Khumbongmayum et al., 2006). Use of boiled extract of leaf was found very common among traditional healers for the treatment of diabetes.

2.14. *Schima wallichii*

Schima wallichiiv (DC.) Korth. (Theaceae) has different ethnobotanical uses among tribal communities (Lalfakjuala et al., 2007). Intensive treatment of hypertension among patients with diabetes with fresh leaves extract was observed during our survey.

2.15. *Wendlandia glabrata*

Wendlandia glabrata DC. (Rubiaceae) is a flowering plant. It is used as an ingredient of indigenous salad *Singju* and people believe that it controls the blood sugar.

3. Materials and methods

3.1. *Instruments and reagents*

α-Glucosidase (Maltase, EC 3.2.1.20), *p*-nitrophenyl-α-D-glucopyranoside and streptozotocin (STZ) were purchased from SRL, Mumbai and Phosphate buffer was procured from Himedia, Mumbai.

3.2. *Plant materials and extraction*

Plants were collected from Manipur, India during January–April, 2014. The identification was authenticated by Dr. B. Thongam, Scientist, IBSD, Imphal and voucher specimen were deposited in the IBSD Herbarium (Supplementary P1).

Air dried plant materials were grinded and extracted with methanol at room temperature thrice, each time for 24 h. The solvent was evaporated with rotary evaporator. The residue was dried under vacuum and finally freeze dried before use for inhibition assay.

3.3. *α-Glucosidase inhibitory assay*

α-Glucosidase inhibitory potency was measured according to a reported method (Kumar et al., 2013). Acarbose was used as positive control and the uninhibited enzyme was taken as negative control (DMSO control). The assay was performed in three independent experiments.

3.4. *Animals*

Albino Wister rats of both sexes weighing 200–320 g were used in this study. They were procured from the Regional Institute of Medical Sciences, Manipur, India. Ethical clearance was obtained from the Institutional Animals Ethical Committee (Approval no.–IBSD/IAEC/Inst./NPC/22) prior to the experiments.

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