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Bioprospecting of Anti-Diabetic Phyto-Resources

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Introduction

Globally a massive change in lifestyle has caused great impact on health. World Health Organisation has recognised diabetes as one among 4 priority non-communicable disorders besides cancer, cardiovascular disorders and respiratory diseases. Diabetes is one of the fastest growing Global health emergencies of the 21st century. In 2019, it is estimated that 463 million people have diabetes and this number is projected to reach 700 million by 2045. In South-East Asia including India, the rate is expected to skyrocket to 74%. South-East Asia occupies second position in world in terms of death due to diabetes.

Wide range of medication facilities are now available against diabetes but plant-based drugs are considered to be less toxic and free from side effects than synthetic one. Diabetes is a serious long-term condition that occurs when there are raised levels of glucose in a person's blood because their body cannot produce any or enough of the hormone insulin or cannot effectively use the insulin it produces. One in six people with diabetes in the world is from India being a highly populated and developing nation, it is important to focus more on prevention and multi-dimensional approaches for reducing the impact of diabetes. World Health Organization had categorized diabetes into many types in which Type 1 and type II are prominent.

Importance of herbal Anti Diabetic agents

Complementary and alternative medicine (CAM) is the term for medical products and practices that are not part of standard medical care. The Global use of CAM for diabetes is increasing rapidly and this includes the use of herbal medicines, dietary supplements and other therapies like yoga, meditation etc. About 80% of the world's population depends only or partially on traditional medicine for its primary health care needs. Herbal anti diabetic agents have been in use for centuries and today it is used individually in prediabetic stage or

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along with conventional medicines for combating diabetic complications. Use of herbal medicine is on progress since up-to-date analysis and experiments show their importance in the treatment and prevention of diabetes due to their natural origin and lack of side effects. During last few years, bioactive drugs have been isolated from plants showing anti diabetic potential. The effect of these phyto resources reduce the diabetic complications and delay the advancement of pre-diabetic to diabetes.

Bioprospecting

Bioprospecting is the systematic search for biochemical and genetic information in nature in order to develop commercially valuable products for pharmaceutical, agriculture, cosmetic and other applications. The first step of bio prospecting involves collection of traditional knowledge from ethnic groups and traditional health practitioners through surveys and an ethnopharmacological database have to be prepared. The phytochemicals responsible for the therapeutic action will be isolated and studied. The efficiency of the phyto compounds are tested invitro and in vivo analysis followed by the clinical trial in humans leading to the pharmarceutical drug or nutraceutical development.

Anti Diabetic phytoresources:

In India, the knowledge on anti-diabetic medicinal plants was prevalent from the era of pioneers like charaka and sushruta and has been in practice among different ethnic groups for centuries. Numerous medicinal plants are used for pre-diabetes and diabetes along with allopathic medicine as it is therapeutically proven for hypoglycemic property. The phytoresources have multiple functions in reducing the blood glucose level. Most common functions of anti-diabetic phyto resources are i) to increase the secretion of insulin hormone ii) to raise the glucose uptate and utilisation iii) to reduce protein glycation and iv) to reduce insulin resistance.

Insulin Secretion Enhancers

1. ***Aegle marmelos* (Indian bael):** Indian Bael is a sacred tree originated in India and the whole plant part is medicinal. its roots are the component in the reputed dasamoola formulation. Indian bael is used against diabetes throughout India in different forms. Leaves are ingested in the form of paste or powder along with milk in Assam. Leaf juice is taken in empty stomach in Odisha. Tribal groups in Wayanad consume the decoction of Indian be lbark along with crushed roots of oroxylum sp.

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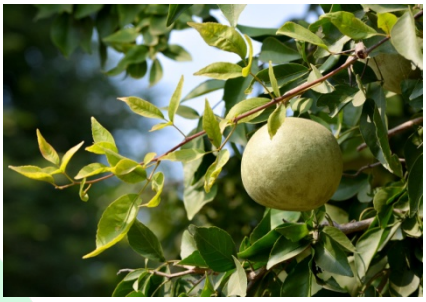
and Premna sp. The anti diabetic compound of Indian bael is Umbelliferone β- D-galactopyranoside which can increase the pancreatic secretion of insulin and the liver enzymes for glucose utilization.



2. ***Catharanthus roseus*** **(Madagascar periwinkle):** Periwinkle is a perennial plant commonly found in tropical countries and is native to Madasgascar and Southern Asia. It is traditionally used among Southeast Asian tribes in fresh form and also as root decoction (120 ml twice daily) and flower decoction (20 ml thrice daily). One or two leaves are chewed daily for reducing blood sugar. Along with this, consumption of leaf juice is also practiced by the North East Indian tribes.

3. ***Gymnema Sylvestre*** **(Sugar destroyer or Australian cow plant):** It is a perennial woody vine originated from Tropical Asia which is a prime phyto resource for diabetic cure since time immemorial. In Sanskrit it is called as madhunashini which literally means sugar destroyer. Fresh leaves and juice of madhunashini are consumed daily for diabetes. Also, the dried leaf powder is mixed with water or milk and consumed. oral ingestion of decoction using dried madunashini leaves along with coconut flower for curing diabetes is also recorded.

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4. ***Costus pictus*** **(Insulin plant):** it is known in the name of the hormone or the drug insulin. It is a rhizomatous medicinal herb commonly known as insulin plant it is well known for its therapeutic properties and widely used for curing diabetes. South Indian tribes consume the fresh leave as such or in the form of juice. A prominent anti diabetic compound daucosterol.

Glucose Uptake and Utilization Enhancers

1. ***Tinospora cordifolia*** **(Heart-leaved moonseed):** It is a climber in which stem is used widely for curing diabetes. Fresh stem is pounded to extract the juice and 15 to 30 ml is consumed thrice daily. Also, the pounded stem is kept in water overnight and consumed in morning hours to cure diabetes. Palmatine, magnoflorine and jattorrhizine are the antidiabetic compounds in *Tinospora cardifolia.*

2. ***Ipomoea digitata*** **(Milk yam):** It is an underutilized important medicinal climber where dried tuber powder is boiled in water and consumed with milk for curing diabetes. Scopoletin and β-sitosterol are found to be the antidiabetic compounds in *Ipomea digitata.*

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3. ***Emblica officinalis*** **(Indian gooseberry/Amla):** It is known as 'Vitamin C capsule of nature' is a tree where root, bark, leaves, flowers, fruits and seeds. Fresh fruits are used commonly for diabetes. Also, juice is extracted from fruits and consumed 60 ml twice daily. Decoction is prepared using dried fruits and 120 ml is taken daily for diabetes. A paste is prepared using boiled fruits and terminalia bellerica and taken with 50 ml cow's milk twice daily 1 hour before food. Gallic acid is the anti-diabetic compound present in Amla.

Plants with Anti- Glycation Agents

1. ***Aloe barbadensis*** **(First aid plant):** *Aloe vera* is a succulant plant and its leaf gel has multipurpose effects. In Assam the gel is mixed with lemon juice and consume daily for curing diabetes. Also, 40-to-50-gram fresh leaf pulp is taken once a day in empty stomach. Aloe emodin-8-O- glycoside is the anti-diabetic agent in *Aloe vera.*

2. ***Ocimum*** **sp.:** Tulsi is an aromatic perennial herb which is known as 'Queen of Herbs' for its exceptional medicinal qualities. In Odisha, tender leaves and leaf juice are consumed. Tribal groups in Assam use the Tulsi powder with honey. Also, leaves soaked overnight in water is taken early in morning as well as leaf infusion are

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consumed for combating diabetes widely in Asian culture. the major anti diabetic compounds of ocimum species are eugenol and several phenolic compounds like caftaric acid, caffeic acid, chicoric acid, rosemarinic acid etc.

Plants With Insulin Resistance Producer

1. *Andrographis paniculata* (Kalmegh): It is an erect annual herb commonly known as kalmegh or 'King of Bitters' found throughout India. Its leaves are consumed as such or in the form of juice or decoction for reducing the blood glucose level. Also, a preparation using powder leaves along with boiled rice and milk is consumed 50 ml thrice daily for 120 days to cure diabetes. Andrographolide and didehydroandro grapholide are antidiabetic agent present in kalmegh.

Conclusion:

A wide range of phyto resources are present in nature which can combat the diabetes disorder when used efficiently. The Pharmaceutical drug or nutraceutical is developed after several multidisciplinary processes. The traditional knowledge on plants is collected from traditional healers and ethnic groups using surveys and interviews. Phytochemical studies including invitro and invivo analysis followed by clinical trials in human will be done for ensuring the anti-diabetic activity of the phyto-resource. Pharmaceutical drugs or

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nutraceutical development terminate the bioprospecting studies. The lacunae with the bioprospecting are the benefit sharing. When a traditional knowledge is exploited, the knowledge providers are to be benefited either in terms of monetary or non-monetary benefits.