



## A REVIEW ON *INDIGOGERA ASTRAGALINA* AS ANTIDIABETIC HERBS

Mrunal K. Shirsat<sup>1</sup> and Siju V. Mathew<sup>2</sup>

<sup>1</sup>Faculty of Pharmacy, Pacific University Udaipur Rajasthan

<sup>2</sup>Research Scholar, Department of Pharmacognosy, Pacific University Udaipur Rajasthan

### Abstract:

Species of *Indigofera* are mostly shrubs, though some are small trees or herbaceous perennials or annuals. Most have pinnate leaves. Racemes of flowers grow in the leaf axils, in hues of red, but there are a few white- and yellow-flowered species. The fruit is a legume pod of varying size and shape. *Indigofera* is a varied genus that has shown unique characteristics making it an interesting candidate as a potential perennial crop. Diabetes is defined as a state in which homeostasis of carbohydrate, protein and lipid metabolism is improperly regulated as a consequence of a relative or absolute deficiency of insulin secretion, resistance to insulin action or both at one or more points in the complex pathways of hormone action. India has 2.4% of world's area with 8% of global biodiversity. It is one of the 12 mega-diversity hot-spot regions of the world. There are about 45,000 plant species in India, with concentrated hotspots in the region of Eastern Himalayas, Western Ghats and Andaman & Nicobar Island. It is difficult to estimate the number of medicinal and aromatic plants present worldwide.

**Key words:** *Indigofera*, Diabetes, Herbal Medicine, Racemes.

### 1. INTRODUCTION

The word *diabetes* is Greek for a draw off, referring to the ejection of a more quantity of urine; and *mellitus* is Latin used for sugar. Consequently diabetes mellitus means the passage of huge amounts of sweet urine. This is derived from the information that excess glucose in the blood spills over into the urine, absorbing fluids with it. Diabetes mellitus is a clinically and hereditarily heterogeneous group of disorders characterized by abnormally elevated levels of glucose in the blood. The hyperglycemia is due to lack of insulin secretion or to resistance of the body's cells to the action of insulin, or to a combination of these. Frequently there are also disturbances of carbohydrate, fat, and protein metabolism.

#### 1.1 Epidemiology of Diabetes Mellitus

Demographic and epidemiological evidences suggest that in the absence of effective involvement of diabetes will persist to increase its incidence worldwide. Therefore prevention of diabetes and its consequences is not just a major challenge for future but essential, if health for all is to be an achievable target.

#### 1.2. Diabetes Mellitus Scenario in India

India goes in front the world with leading number of diabetic patients earning the doubtful distinction of being termed the "diabetes capital of the earth". In India simply, the occurrence of diabetes is expected to

rise from 31.7 million in 2000 to 79.4 million in 2030 (Wild et al, 2004). The World Health Organization guess that death from diabetes as well as heart disease cost India about \$210 billion each year and is likely to increase to \$335 billion in the subsequently ten years (Bjork, 2003).

#### 1.3 Insulin

Insulin, the most important hormonal regulator of glucose metabolism, was earliest isolated from pancreatic tissue and it is a quite small protein, with a molecular weight of around 6000 Daltons. (Banting and Best, 1922). Insulin is a 51 amino acid anabolic peptide-hormone that is secreted by the  $\beta$ -cells in the Islets of Langerhans. Insulin made up of two chains (A and B) linked by disulfide bonds.

#### 1.4 Type 1 Diabetes Mellitus ( $\beta$ -cell destruction, frequently leading to absolute insulin deficiency)

This usually leads to a type of diabetes in which insulin is required for survival. Individuals with type 1 diabetes are metabolically normal before the disease is clinically manifest, but the process of  $\beta$ -cell destruction can be detected earlier by the presence of certain autoantibodies. Type 1 is usually distinguished by the presence of anti-GAD, islet cell or insulin antibodies which discover the autoimmune processes that lead to beta-cell destruction. This form of diabetes previously encompassed by the terms Type I diabetes, Insulin dependent diabetes or juvenile-onset diabetes results

from autoimmune mediated destruction of beta cells of pancreas (Atkinson and Maclaren, 1994).

### **1.5. Type 2 Diabetes Mellitus (ranging from primarily insulin resistance with relative insulin deficiency to predominantly an insulin secretory defect with insulin resistance)**

This type of diabetes consists of heterogeneous conditions responsible for approximately 90% of all individuals with diabetes. . It is often associated with central or visceral obesity, as well as other cardiovascular risk factors such as hypertension, and abnormalities of lipoprotein metabolism with the characteristic dyslipidemia of elevated triglycerides and low high-density lipoprotein cholesterol.

## **2. HERBAL MEDICINE AND THEIR POTENTIAL TO TREAT DIABETES MELLITUS**

Long before the birth of orthodox Western medicine, medicinal herbs were applied to treat a wide range of disease categories (Basch et al, 2003). Due to emphasis on scientism and other complicated reasons, Western medicine now prevails over “traditional” forms of medicine including herbal medicine systems. The use of a medicinal herb, alone or in combination with other herbs, can be thought of as a type of combination therapy because of the complexity of the phytochemicals and bioactivities in the plant. Thus, a single antidiabetic herb with thousands of phytochemicals may have multiple benefits by targeting several metabolic pathways and essentially “killing several birds with one stone.” One study supported this principle by demonstrating that a combination therapy of orthodox medicine and herbal medicine exhibited a better (synergistic) effect than either medicine alone (Kaur et al, 2012). Therefore, herbal medicine can complement orthodox therapy in diabetes mellitus and provides hope for a cure.

A huge number of plants have been used for the treatment of diabetes all over the world. In fact, in many parts of the world particularly in poor countries, this may be the only form of therapy available for treating diabetic patients. There are several literature reviews by different authors about anti-diabetic herbal agents, but the most informative is the one on anti-diabetic plants by Rahaman and Zaman, 1989. This review documented more than 300 plant species accepted for their hypoglycemic properties and

classified according to their botanical names, country of origin, parts used and nature of active agents. Some of the plants available in India that are reported to have antidiabetic properties are *Achyranthes aspera*, *Aegle marmelos*, *Anacardium occidentale*, *Areca catechu*, *Artemisia pallens*, *Bauhinia forficata*, *Beta vulgaris*, *Calmellia sinensis*, *Cassia auriculata*, *Cassia fistula*, *Ceiba pentandra*, *Encostemma littorale*, *Indigofera astragalina*, *Euphorbia prostrata*, *Ficus hispida*, *Ganoderma lucidum*, *Gum arabic*, *Gymnema sylvestre*, *Lepechinia caulescens*, *Memecylon umbellatum*, *Momordica charantia*, *Musa sapientum*, *Nigella sativa*, *Ocimum sanctum*, *Opuntia fukiginosa*, *Pterocarpus marsupium*, *Rhizoma polygonati*, *Salacia reticulata*, *Smallantus sonchifolius*, *Terminalia catappa*, *Tinospora cordifolia* and *Vinca rosea* (Oliver-Bever, 1986; Rahman and Zaman, 1989; Bailey and Day, 1989; Ivorra et al, 1989; Nagaraju and Rao, 1990; Swanston-Flatt et al, 1990; Handa, 1991; Rastogi and Mehrotra, 1993; Marles and Farnsworth, 1995; Rai, 1995; Rajathi and Daisy, 2003; Jasmine and Daisy, 2004; Daisy et al, 2004a, b, 2007; Chen et al, 2005; Narendhirakannan et al, 2006; Al-Fatimi et al, 2007). Though many of the plants are reputed in the indigenous systems of medicine for their hypoglycemic activities, several are unknown to the medical community, since these remain to be scientifically established along with their active compounds (Kameswara Rao et al, 2001a; Jayakar and Suresh, 2003; Subash Babu et al, 2007).

### **3. INDIGOFERA ASTRAGALINA**

*Indigofera* is a varied genus that has shown unique characteristics making it an interesting candidate as a potential perennial crop. Specifically, there is diverse variation among species with a number of unique characteristics. Some examples of this diversity include differences in pericarp thickness, fruit type, and flowering morphology. The unique characteristics it has displayed include potential for mixed smallholder systems with at least one other species and a resilience that allows for constant nitrogen update despite varying conditions.

#### **3.1. Synonyms**

*Indigofereae*

#### **3.2 Vernacular Names**

Kingdom:Plantae

(unranked):Angiosperms

(unranked):Eudicots

(unranked):Rosids

Order: Fabales

Family: Fabaceae

Subfamily:Faboideae

Tribe: Indigofereae

Genus: Indigofera

### 3.3. Botanical description

Species of *Indigofera* are mostly shrubs, though some are small trees or herbaceous perennials or annuals. Most have pinnate leaves. Racemes of flowers grow in the leaf axils, in hues of red, but there are a few white- and yellow-flowered species. The fruit is a legume pod of varying size and shape.

### 3.4 Distribution

Many of the species will also succeed in drier conditions and in poor soils. This species has a symbiotic relationship with certain soil bacteria; these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby.

### 3.5 Habitat/ecology

Sandy grounds; muddy sand; sand on sandstone; often ruderal; rocaille; waste or cultivated ground; heavily grazed grassland; at elevations up to 1,800 metres

**3.6 Propagation:** It can be propagated through seed.



Figure 1: Plant of *Indigofera astragalina*

### 4. TRADITIONAL USES AND ETHNOPHARMACOLOGY OF *INDIGOFERA ASTRAGALINA*

*Indigofera astragalina* is having rich value in folk medicine and is widely used in ayurvedic system of medicine. The following table describes the traditional value of whole plant and their parts

Table:1 Traditional Uses and ethnopharmacology of *Indigofera astragalina*

Traditional System	Plant Part	Use	Reference
Ayurveda	Whole plant	Guinea worm infestations, Purgative, Diuretic, leprosy, skin – diseases, inflammation and bilious fevers	Chopra et al, 1986
	Seeds	Antidote in Snake poisoning, Emetic, Expectorant, Demulcent, Laxative, Curing warts, Cold sores, cutaneous infections, itches, jaundice & Dropsy	Jyothi et al, 2011
	Juice of plant	Ophthalmic , Opacity of Cornea, dropsy, jaundice, skin diseases, leprosy, blisters, conjunctivitis	Osho et al, 2010
	Roots	Used in Leprosy, Inflammations, pruritus, blennorrhagia	
Homeopathy	Whole plant	Tapeworm infections, Whooping cough & Bronchitis	Kala, 2005
Siddha	Whole plant	Venereal sores, photophobia, scorpion bite, leucorrhoea. The latex of <i>Indigofera astragalina</i> used to treat boils by topical application on the site of boils Treat Dental disorders	Ganesan, 2008
	Leaves	Leaf decoction is used in the treatment of malarial fever and ulcers. Leaves along with black pepper are used to cure diabetes.	
	Seeds	Leprosy, Jaundice & Dropsy	Alagesaboopathi, 2009

Unani	Whole plant	Acts in enrichment of blood showing the activity as an Aphrodisiac and Expectorant. Skin diseases & Leucoderma	Chaudhari et al, 1985
Ethno-pharmacology	Leaf juice	Cuttack district of Odisha in treating fresh cuts and wounds	Dash et al, 2011
<b>Traditional System</b>	<b>Plant Part</b>	<b>Use</b>	<b>Reference</b>
	Seed powder	Tribal and non-tribal inhabitants of Andhra Pradesh used for treating asthma	Savithamma et al, 2007
	Root	In Karnataka tribal peoples use for treating painful tooth. Bidar district, Karnataka used in the treatment of gynecological disorders in women like Menorrhoea, leucorrhoea	Hebbar et al, 2004; Vidyasagar et al, 2007
	latex	In Rajasthan using for Rheumatism arthritis	Katewa et al, 2004
	Whole plant	Utility in diabetes. In Jamaica plant decoction used for the treatment prevention of hypertension	Adolfo et al, 2005; Robert et al, 2005

## 5. CONCLUSION:

The approach to new drugs through natural products has proved to be the single most successful strategy for the discovery of new drugs, but in recent years its use has been deemphasized by many pharmaceutical companies in favor of approaches based on combinatorial chemistry and genomics, among others. However over the past decade, there has been a resurgence of interest in the investigation of natural materials as a source of potential drug substance. Natural products have played an important role throughout the world in treating and preventing human diseases. Natural product medicines have come from various source materials including terrestrial plants, terrestrial microorganisms, marine organisms, and terrestrial vertebrates and invertebrates (Newman et al, 2000) and its importance in modern medicine has been discussed in different reviews and reports (Newman et al, 2000; Newman et al, 2003; Koehn and Carter, 2005; Paterson and Anderson, 2005; Balunas and Kinghorn, 2005; Jones et al, 2006;).

## REFERENCES:

1. Wild, S., Roglic, G., Green, A., Sicree, R., King, H., 2004. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 27, 1047-53.
2. Banting, F.G., Best, C.H., 1922. Pancreatic extracts. *Journal of Laboratory and Clinical Medicine* 7, 464-472.
3. Atkinson, M.A., Maclaren, N.K., 1994. The pathogenesis of insulin dependent diabetes. *The New England Journal of Medicine* 331, 1428-1436.
4. Basch E., Ulbricht C., Kuo, G. Szapary P., and Smith, M., 2003. Therapeutic applications of fenugreek. *Alternative Medicine Review* 8(1), 20-27.
5. Kaur, K., Bedi, G., Kaur, M., Anil, V., Kaur, I., 2008. Lipid Peroxidation and the Levels of Antioxidant Enzymes in Coronary Artery Disease. *Indian Journal of Clinical Biochemistry* 23(1), 33-37.
6. Kameswara Rao, B., Giri, R., Kesavalu, M.M., Apparao, C., 2001. Effect of oral administration of bark extracts of *Pterocarpus santalinus* L. on blood glucose level in experimental animals. *Journal of Ethnopharmacology* 74(1), 69-74.
7. Nadkarni, K.M., 1982. *Indian Materia Medica*. Published by Bombay popular prakashan, Vol.-I, 133.
8. Perriello, G., Misericordia, P., Volpi, E., 1994. Acute Antihyperglycaemia mechanisms of metformin in NIDDM: evidence for suppression of lipid oxidation and hepatic glucose production. *Diabetes* 43: 920-928.
9. Sapakal, V.D., Shikalgar, T.S., Ghadge, R.V., Adnaik, R.S., Naikwade, N.S., Magdum, C.S., 2008. In vivo screening of antioxidant profile: A review. *Journal of Herbal Medicine and Toxicology* 2, 1-8.
10. Dwivedi, S., Agarwal, M.P., 1994. Antianginal and cardioprotective effects of *Terminalia arjuna*, an indigenous drug in coronary artery disease. *The*

- Journal of the Association of Physicians of India 42, 287-289.
11. Haskins, K., Brenda, B., Katherine, P., Valerie, F., Sonia, F., Xiaofeng, L., Subbiah, P., Jane, R., Jennifer., 2006. Oxidative Stress in Type 1 Diabetes- Immunology of Diabetes: Pathogenesis from Mouse to Man. *Annals of the New York Academy of Sciences* 10 (05), 43–54.
  12. Inzucchi, S.E., 2002. Oral antihyperglycemic therapy for type 2 diabetes. *Journal of the American Medical Association* 287, 360-372.
  13. Ito, C., Furukawa, H., 1990. Antifertility studies of isoquinoline alkaloids with special emphasis of structure activity relationship. *Fitoterapia* 61, 67-71.
  14. Abdullahi, M., Muhammed, G., Abdulkadir, N.U., 2003. Medicinal and economic plants of Nupeland. Jube Evans, 2003.
  15. Allain, C.C., Poon, L., Chan, S.G., Richmond, W., Fu, P., 1974. Enzymatic determination of total serum cholesterol. *Clinical Chemistry* 20, 470.