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A Review on Ethno Medicinal Plants of Southern parts of West Bengal with Anti-diabetic Potential

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Abstract

India has vast resources of plants which possess medicinal properties. These plants and its parts have been used in the treatment of various human ailments since ancient times. Diabetes mellitus is a frequent metabolic disorder which has unfurled across the continents. Researches have been conducted all over the world on the plants which are reported to have anti diabetic properties. The present paper reviews ten (10) such plants which are found in the Southern parts of West Bengal with their active constituents, parts used and mode of action against Diabetes mellitus. The plants which are most used by the local people of South Bengal for remedies against the disease are – *Aegle Marmelos*, *Andrographis Paniculata*, *Asparagus Racemosus*, *Azadirachta Indica*, *Boerhavia Diffusa*, *Butea Monosperma*, *Lagerstroemia Speciosa*, *Pterocarpus Marsupium*, *Syzygium Cumini* and *Tinospora Sinensis*.

Keywords: Diabetes mellitus, herbal medicine, ethno-medicinal plants, South Bengal, Review.

Introduction

The knowledge of folk medicine or herbal medicine used by tribal people of our country as well as state is generally transmitted verbally from generation to generation and is at high risk of disappearance. This predicament calls for documenting this folk knowledge through ethno-pharmacological and experimental studies that can complement current ways of modern medicine. Now a days, uses of medicinal plants with little or no toxicity and fewer side effects have become an important therapeutic possibility for the treatment of many diseases especially diabetes.

Diabetes Mellitus (DM), an endocrinal metabolic disorder which leads to high blood sugar level for a prolonged period of time. It causes both morbidity and mortality in human beings. It also enhances the risks of cardiomyopathy and atherosclerosis. Diabetes Mellitus has become a major health concern of today's world. Almost 1.6 million deaths were reported in 2015 alone (Roglic and Norris 2018) ^[1] and assumed to increase up to 300 million by 2025 (R.H. Williams and P.R. Larsen 2003) ^[2]. Diabetes Mellitus i.e., Type 2 diabetes (non-insulin dependent) is the most common type of this disease, generally characterized by deficiency in insulin secretion or body becoming resistant to it. In either of the case, the situation leads to hyperglycemia (elevated blood sugar level).

Plants have been used as vital source of drugs against innumerable diseases. Several plants have been reported to have hypoglycemic affect and are used as anti-diabetic remedies in rural parts of West Bengal as well as India due to richness in diversity of medicinal plants in the said areas and also economic constraints of procuring modern medicines.

In this review, the author has focused on the plants with anti-diabetic potential reported from southern parts of West Bengal or so-called South Bengal which is mainly comprised of districts like Paschim Midnapore, Purba Midnapore, Jhargram, Purulia, Bankura and South 24 Parganas. These districts have total forest coverage of almost 8287 sq.km. Which houses diverse range of plants with various ethno medicinal values. Besides that, all the districts of the study area encompass a broad range of topographical regions, from the extension of Chhotonagpur plateau to vast tract of forest and salt water swamp forming the lower part of Gangetic Delta; from the deciduous forests dominated by Shal to Mangrove forests grown in halophytic conditions. Though the study area shows diversity in topographic conditions, it shows surprising similarity in the practice and culture using plants or its parts as remedies against various ailments by the native communities of these regions e.g.- Santals, Bhumij, Lodha, Munda etc.

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In the rural parts of India (as well as the study area), the knowledge of 'Folk Medicines' have been used as remedies against Diabetes Mellitus since the time of Charaka and Sushruta i.e. - 6th Century B.C. (Grover and Vats, 2001) [3]. A wide range of Plant derived active constituents (Phytochemical compounds) e.g. - alkaloids, flavonoids, glycosides, peptidoglycans, terpenoids, amino acids etc. are found to have potential use in treatment of Type 2 Diabetes (NIDDM), (Bailey and Day, 1989; Marles and Farnsworth, 1995) [4, 5].

Material and methods

The present study was an outcome of thorough perusal of already published literatures on the major ethno-medicinally important plants that are used as remedies against non-insulin dependent diabetes mellitus (NIDDM). Relevant information and research papers pertaining to this study were searched comprehensively using various established search engines e.g. - Google Scholar, Semantic Scholar, Pub Med, Science direct, Researchgate etc. All possible literature searches were done to meet the expected objectives using these following keywords: Folk medicine, Traditional medicines of West Bengal, Plants having anti diabetic potential, NIDDM etc.

Plants with anti-diabetic potential

In this present study the author made an effort to give concise account of Ten (10) plants which were most reported from the Southern part of West Bengal to have anti diabetic or insulin mimetic properties. All the relevant data e.g. - Scientific name of the plants along with the local vernacular (Bengali), name of the families, brief description of the plants along with active constituents and hypoglycemic properties were provided here.

I) *Aegle Marmelos* (Local name – *Bael*, Family – *Rutaceae*):

- The plant appears as a small to medium sized tree or deciduous shrub and considered to sacred by Hindus. Different parts of the plant e.g. – root, bark, leaves fruits & seeds are used in ayurved for treating various illness, especially diabetes (M.C. Sabu *et al.*, 2004) [5]. It is also proved that the aqueous extract of fruits of *A. Marmelose* also have a protective effect on diabetic rats. A dose of about 125 and 250 mg/kg of fruit extract of *A. Marmelose* was orally administered to diabetic rat which causes a significant decrease in fasting blood glucose levels together with significant increase in body weight (N. Kamalakkannan *et al.*, 2005) [7].

II) *Andrographis Paniculata* (Local name – *Kalmegh*, Family – *Acanthaceae*):

- An erect herbaceous plant, grown in moist shady places and has been used in Ayurvedic and siddha medicine. The different parts of the plant like roots, aerial parts and whole plants have been used for the treatment of various ailments especially diabetes. Major constituents of *A. Paniculata* like Diterpenoids (Andrographolide, Andrographanin), flavonoids (5, 7, 2', 3' - tetramethoxy flavone, 7-O-methylidihydroxogonin, 7-O-methylwogonin, Dihydroskullcapflavone) and other miscellaneous compounds are reported to have antidiabetic properties (Nugroho *et al.*, 2012, Okahuarobo *et al.*, 2014) [8, 9]. Earlier studies reported that the ethanolic extracts of *A. Paniculata* significantly decrease the level of blood glucose in Type-1 DM rats (Zhang *et al.*, 2000) [10] mainly in the presence of andrographolide. The compound also improves the uptake of glucose by increasing the level of insulin as well as translocation of

GLUT 4 in isolated Soleus muscle membrane in alloxan – diabetic rats (Szkudelski T 2001; AE Nugroho, 2012) [11, 8].

III) *Asparagus racemosus* (Local name – *Shatamuli*, Family – *Liliaceae*):

- The plant is a climber (1-2 m tall) with both fibrous and tuberous roots and phylloclades in shape of pine needle. It has a phyto chemical composition of polycyclic alkaloids - Aspargamine A (Sekine 1994, 1995) [12, 13], steroidal saponins (Gaitonde and Jet Malani 1969) [14] – Shatvarin, Sitosterol (Singh and Tewari 1991) [15] etc. The ethanolic extract of root along with hexane, chloroform and ethyl acetate was found to have dose dependent insulin secretion in isolated pancreatic cells of rats and also in rabbits (Hannan *et al.*, 2007; Alok *et al.*, 2013) [16, 17].

IV) *Azadirachta indica* (Local Name – *Neem*, Family – *Meliaceae*):

- It is a medium to large sized deciduous tree (15-20 meters tall), generally found in sub humid conditions but it can survive in regions with low annual rainfall. It shows a rich composition of active constituents e.g. - Nimbin, Nimbidin, Nimbolinin, 6-desacetyl nimbinene, Nimbenane, Nimbiol (Kokate *et al.*, 2010) [18]. 70% alcoholic Neem root bark extract was found to have anti diabetic activity (Patil *et al.*, 2013) [19] in dose dependent manner. The plant exerts its hypoglycemic activity by blocking the action of epinephrine on glucose metabolism which in turn increases the utilization of peripheral glucose (Chattopadhyay, 1998) [20]. Chloroform extracts of *A. Indica* were investigated and results showed good oral glucose tolerance and decreased intestinal glycosidase activity (Joshi *et al.*, 2011) [21].

V) *Boerhavia Diffusa* (Local Name – *Punarnaba*, Family – *Nyctaginaceae*):

- A creeping, perennial, herbaceous plant of wide spread distribution. Stems are purplish, leaves are ovate and flowers are small deep purplish in color. The leaves of the plant are reported to have reducing effect on blood glucose level (Chude *et al.*, 2001) [23]. Hypoglycemic effect and increase in plasma insulin levels were observed in diabetic rats treated with BLEt by increasing hexokinase activity and decreasing glucose 6 phosphate and fructose 1, 6 bisphosphatase activity (Pari and Satheesh, 2004) [23].

VI) *Butea Monosperma* (Local name – *Palash*, Family – *Fabaceae*):

- A small sized deciduous tree with bright red flower, frequently found in districts like Purulia, Bankura, Birbhum, Paschim Midnapur and Jhargram which are extension of Chhotonagpur plateau topographically. Hydroethanolic extract of *B. Monosperma* bark was reported to show anti-hyperglycemic and anti-hyperlipidemic effect on alloxan induced diabetic mice (Shrama and Garg, 2012) [24]. Fifty percent (50%) ethanolic extract of the flower also shows anti-hyperglycemic and anti-oxidative effect on alloxan induced diabetic mice (Sharma and Garg, 2009) [25].

VII) *Lagerstroemia Speciosa* (Local name – *Jarul*, Family – *Lythraceae*):

- A small to moderate sized deciduous tree generally grows in all parts South Bengal. Flowers with distinctive purple petals grow in erect panicles and blooms only once in a year mainly during summer. Leaves of *L. Speciosa* are generally consumed for remedies against diabetes and kidney related diseases (Klein *et al.*, 2007) [26]. The most effective active constituent, i.e. – Lagerstroemin and Corosolic acid (2 α hydroxyrusolic acid) which was extracted from methanolic extract of leaves and was experimented on tumor cell line coupled with a bioassay

guided fractionation, showed anti-diabetic potentialities (Kakuda *et al.*, 1996; Sujuki *et al.*, 1999; Hayashi *et al.*, 2002) [27-29].

VIII) *Pterocarpus Marsupium* (Local name – *Pia sal*, Family – *Fabaceae*):- A moderate to large tree commonly grows in the stretches of southern parts of West Bengal where lateritic soil is found. Alcoholic extract of the bark of the plant shows anti diabetic activity in alloxan induced diabetic rats (Dhanabal *et al.*, 2006) [30]. *P. marsupium* is also found to have control on diabetes related metabolic alterations apart from controlling glucose levels (Dhanabal *et al.*, 2006) [30]. Pterostilbene, an active constituent of *P. marsupium* caused hypoglycemia in dogs (Haranath *et al.*, 1958) [31]. Flavonoid extracted from the plant has been reported to cause regranulation of cells of pancreas which also in turn controls the glucose levels in blood (Chakravorty *et al.*, 1980; Sheehan *et al.*, 1983) [32, 33].

IX) *Syzygium Cumini* (Local name – *Jam*, Family – *Myrtaceae*):- This is a large evergreen tropical tree, found throughout the India with deep purple to black drupaceous fruits. Seeds are widely used as herbal remedy against DM for its hypoglycemic effect (Coimbra *et al.*, 1992) [34]. Plant extract of *S. Cumini* has been found to increase Cathepsin B activity, i.e. - Proteolytic conversion of Pro insulin to insulin (Bansal *et al.*, 1981) [35]. Oral feeding of pulp extract of the fruit also showed hypoglycemic activity in STZ induced diabetic rats, probably by increasing insulin secretion and preventing insulinase activity.

X) *Tinospora Sinensis* (Local name – *Gulanha*, Family – *Menispermaceae*):- It is a deciduous, shrubby climber with heart shaped leaves and reddish fruits borne in clusters. It is also widely used as folk medicine for its hypoglycemic effects (Nandkarni, 1992) [36]. Oral administration of hydrous extract of *T. Cordifolia* root shows marked reduction in blood glucose level, hepatic Glucose 6 phosphatase and increase in body weight and hepatic hexokinase in alloxanized diabetic rats (Stanley *et al.*, 2001) [37].

Discussion

People of native communities residing in marginal areas or in dense forests of our state cannot afford the luxury of modern medicine or medical sciences mainly due to economic constraints and remote location of their habitats. They have to rely on the natural resources and knowledge of local tribal 'medicine men' for curing of diseases. Though many of the modern drugs are produced on the basis of the chemicals extracted from the plants, tribal people are not privileged to those medicines. So, they use these herbal medicines in the form of juice, decoction, tablets etc. produced by the local 'medicine men' from the plants with ethno medicinal properties.

As stated before, Diabetes Mellitus (DM) is an endocrinal disorder which hampers the metabolism of carbohydrate as well as fat and protein by the decreasing insulin secretion or inhibiting absorption of it by the cells. Today, diabetes is not only confined to the people of means or residing in cities, it has also reached to the rural areas of our country as well as state where the blessing of today's medicine is yet to avail.

In conclusion, this paper has presented ten (10) plants which are frequently found in the Southern parts of West Bengal and used by the native people for remedies against DM. The active constituents, mode of antagonistic effect on

hyperglycemia and related activities of those plants are mentioned here. As Diabetes Mellitus (DM) has become a global health concern, more and more studies and investigations are needed on the plants with anti-diabetic activity from different parts of our country as well as state to evaluate their mode of action against the disease to produce more efficient and side effect free medicines.

Conflict of interest statement

I declare that I have no conflict of interest.

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