J. Indian bot. Soc. ISSN - 0019 - 4468 Vol. 93 (1 & 2) 2014 : 126-131

"ETHNO-BOTANICAL STUDIES ON MEDICINAL FLORA HAVING PROPERTIES TO CONTROL HYPERGLYCEMIA"

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Hyperglycemia is a major symptom of Diabetes mellitus and a causal agent of many other major complications of Diabetes mellitus. Many synthetic hypoglycemic drugs such as sulphonylurea and biguanides cause side-effects and are so costly. Herbal drugs are safer and ease in accessibility. Plants are rich in bioactive compounds. Many of them are medicinally important and having hypoglycemic properties While working on the ethnobotanical studies in the Shekhawati region of Rajasthan, about 26 plants were identified having hypoglycemic potential. These plants belong to 20 families and are growing wildly or cultivated.

Keywords: Hyperglycemia, Sulphonylurea, Biguanides, Ethnobotany, Shekhawati.

Since the beginning of civilization, curiosity of human forced him to go depth of nature. He started domestication of plants, which increase his knowledge about plants day by day. Now, plants become an important part of each aspect of his life. Plants have been in use for medicinal purpose from ancient times, which was also well documented in important Indian cultural books like Rigveda, Ayurveda, Charak Samhita, Sushruta Samhita, etc.

In India, about 80% of the rural population is dependent upon indigenous system of medicine, which mainly uses plant materials.

Ethnobotany is the documentation of relationship between people of a particular place and indigenous plants. Ethnobotanical studies explore how indigenous plants are used by people.

Extensive chemical and pharmacological investigations have revealed that plants possess vast array of secondary metabolites, which have different types of biological activities. Some of the chemicals are really unique with specific properties and provide new leads for drug development. Plants contain many useful phytochemicals, which make them useful for medicinal purpose (Mradu Gupta *et. al.* 2009). Several botanical supplements have been studied as potential therapeutic agents in the management of diabetes and its related complications. These active principles are dietary fibres, alkaloids, flavonoids, saponins, amino acids, steroids, peptides and others. These have produced potent hypoglycemic, anti-hyperglycemic and glucose suppressive activities.

Hyperglycemia or high blood sugar is a condition in which an excessive amount of glucose circulates in the blood plasma. Chronic hyperglycemia is most commonly caused by diabetes mellitus. Hyperglycemia is caused by low insulin levels. Low insulin levels prevent the body from converting our primary energy source glucose into glycogen, which is our body's reserved energy source. The body's ability to convert glucose into glycogen and back into glucose is common in order to maintain homeostasis. Hyperglycemia prevents the glucose-glycogen conversion and allows sugar to circulate the blood more so than normal even with the body at rest.

Study area

The Shekhawati region consists of two districts, Sikar and Jhunjhunu, located in North-east part of Rajasthan, India. Its area is 13784 square kilometres. It is semi-arid desert area of Rajasthan. It has very harsh and extreme climatic conditions. The temperature ranges from below 0°C (32 °F) in winter to more than 50°C (122 °F) in summer. Annual rainfall is at around 450 to 600 mm. It lies between 28.06^0 North latitude and 75.20^0 East longitudes. It has 480 m altitude.

METHODOLOGY

During the working on ethnobotanical studies in the Shekhawati region, about 26 plants were reported having hypoglycemic potential. In order to listing medicinal flora of the study area, many small field trips were conducted in different seasons. Plants, used

Received on April 20, 2012 Accepted on November 1, 2013

to cure hyperglycemia, were sorted out from them on the basis of discussion with rural people and authenticated books.

First of all, plants were identified with the help of local inhabitants and confirmed with available flora (Kirtikar and Basu 1935). Interviews of about 40 informants were taken during these surveys, in which 27 were men and 13 were women. Ethnobotanical and medicinal data were collected from them. Obtained data was cross checked with literatures and herbal doctors or vaidhyas.

RESULT AND DISCUSSION

Knowledge about the use of plants among indigenous people indicates their close affinity with plants of the area and nature. During the field trips, about 26 hypoglycemic plants were reported from the study area belonging to 20 families. Many of them are grown wildly e. g. *Achyranthes aspera*, *Adhatoda zeylanica*, etc. Many of them are cultivated in houses, due to having religious importances such as *Aegle marmelos*, *Phyllanthus emblica*, *Ocimum tenuiflorum*, *Musa paradisiaca*, etc. Some plants like *Ficus benghalensis* and *Ocimum tenuiflorum*, etc. are found near the religious places.

Some more plants were identified from the study area, having hypoglycemic potential. But, they are found only some selected areas like *Butea monosperma*, *Musa sapientum* L., etc.

Enumeration

Acacia nilotica (L.) Del. ssp. *indica* (Fabaceae). Babool. Leaves (Munazza Asad *et al*. 2011) and pods (Maqsood Ahmad *et al*. 2008) are hypoglycemic. Pods showed an antidiabetic effect because of the tannins and polyphenols (Maqsood Ahmad *et al*. 2008).

Achyranthes aspera L. (Amaranthaceae). Undakanta. Whole plant is used in diabetes. It provides certain necessary elements like calcium, zinc, magnesium, manganese and copper to the beta-cells (Akhtar and Iqbal 1991).

Adhatoda zeylanica Medik. (Acanthaceae) Adusa. Leaves and roots are hypoglycemic. Plant contains vasicine and vasicinol, which shows hypoglycaemic effect (Hong Gao *et al*. 2008).

Aegle marmelos (L.) Correa (Rutaceae). Beal. Leaves contain an alkaloid-amide, Aegeline 2 (Narender *et al*. 2007).

Aloe vera (L.) Burm. F. (Liliaceae). Gwarpatha. Gel shows antidiabetic effect. Five sterols lophenol, 24-methyl-lophenol, 24-ethyl-lophenol, cycloartanol, and 24-methylene-cycloartanol have hypoglycaemic activity (Tanaka *et al*. 2006).

Allium cepa L. (Liliaceae). Onion. Allyl propyl disulfide in onions has been found to have antidiabetic properties. It stimulates insulin release and action, thereby enhances cellular uptake and utilization of glucose in animals (Eyo *et al*. 2011).

Allium sativum L. (Liliaceae). Garlic. S–allyl cysteine sulfoxide (allicin) a sulphur containing amino acid is responsible to cure diabetes mellitus (Augusti and Sheela, 1992). Garlic can act as a hypoglycaemic agent by increasing either the pancreatic secretion of insulin from the beta cell or it release from bound insulin (Jain and Vyas, 1975).

Azadirachta indica A. Juss. (Meliaceae). Neem. Whole parts of the plant are used as hypoglycemic agents. The active chemical, Nimbidin, found in seed, showed hypoglycemic effect in fasting rabbits (Pillai *et al*. 1984).

Boerhavia diffusa L. (Nyctaginaceae). Santa. The plant has a significant hypoglycemic effect due to chemical components as alkaloids, sterols and triterpens (Guessan *et al*. 2011).

Cassia fistula L. (Caesalpiniaceae) Amaltash. The stem bark of plant contains catechin which has hypoglycemic activity by activating Insulin receptor and Peroxisome proliferator-activated receptor gamma (Daisy and Manikkam 2012).

Catharanthus roseus (L.) G. Don (Apocynaceae) Sadabahar. Leaves of the plant are widely used as anti

-diabetic drug. It has capacity to alter the activities of enzymes of glucose metabolism (glycogen phosphorylase, hexokinase, phosphofructokinase, pyruvate kinase, and glucose-6-phosphate dehydrogenase) (Karuna et al., 2010). Alkaloids such as vindoline and vindolinenine are responsible for its hypoglycaemic activity (Ivorra *et al.* 1989).

Coccinia grandis (L.) J. Voigt (Cucurbitaceae) Binbi. Leaves and fruits are hypoglycemic. Its hypoglycemic activity is due to the repression of the key gluconeogenic enzyme glucose-6-phosphatase. Fruits have pectin, responsible for hypoglycaemic activity (Prasannakumar *et al.* 1993).

Ficus benghalensis L. (Moraceae) Bargad. Bark is used to cure diabetes. Bark contains leucocynidine (3-O-D-galactosylcellobioside) and glucosides (Bengalinoside) and flavonoids (Kumar and Augusti, 1989 and Cherian and Augusti 1993).

Ficus religiosa L. (Moraceae) Pipal. Aqueous extract of *Ficus religiosa* bark possesses significant antidiabetic activity (Ruche Pandit *et al.* 2010).

Mangifera indica L. (Anacardiaceae) Mango. Leaves are hypoglycemic due to the presence of Mangiferin (Muruganandan *et al.* 2005).

Momordica charantia L. (Cucurbitaceae) Karela. Whole parts of the plant are used to cure hyperglycemia. Charantin is responsible for its anti-diabetic capacity (Rahul *et al.* 2008).

Moringa oleifera Lam. (Moringaceae) Sahjan. Leaves and fruits are used to cure diabetes. Aqueous extract of leaves reduces the blood glucose level and also improves glucose tolerance (Dolly Jaiswal *et al.* 2009). Hypoglycemic and antihyperglycemic activity of the leaves of *Moringa oleifera* may be probably due to the presence of terpenoids, which appears to be involved in the stimulation of the β-cells and the subsequent secretion of preformed insulin (Manohar *et al.* 2012).

Ocimum tenuiflorum L. (Lamiaceae) Tulsi. Leaves have the stimulatory effect on the physiological pathway of insulin secretion (Hannan *et al.* 2006). Whole plant contains eugenol, which shows hypoglycemic activity (Upendra *et al.* 2010).

Phyllanthus emblica L. (Euphorbiaceae) Amla. Fruits, seeds and leaves of Emblica officinalis are used to cure diabetes. It decreases in fasting serum glucose level and increase in glucose tolerance in streptozotocin induced diabetes in rats (Tirgar *et al.* 2011).

Phyllanthus amarus Schum. (Euphorbiaceae) Bhumiamla. Leaves are antidiabetic. It enhances insulin release from surviving β-cells. The flavonoids and tannins present in the plant extract known to possess antidiabetic activity (Herbert *et al.* 2011).

Psidium guajava L. (Myrtaceae) Amrud. Unripe fruits and leaves are hypoglycemic. The aqueous or ethanol extract of guava leaves showed a significant reduction in the blood sugar level in diabetic rats (Shen *et al.* 2008).

Punica granatum L. (Punicaceae) Anar. Flowers, seeds and rind are hypoglycemic. Punica granatum aqueous peel extract significantly lowered blood sugar and increased insulin level through regeneration of ß cells (Enas AM Khalil 2004).

Syzigium cumini L. (Skeels.) (Myrtaceae) Jamun. Fruits and seeds are hypoglycemic parts of the plant. 'Mycaminose' isolated from seeds, ethyl acetate and methanol extracts of seeds possess anti-diabetic effects against STZ-induced diabetic rats (Kumar *et al.* 2008).

Tinospora cordifolia (Thumb.) Miers. (Menispermaceae) Giloy. Stem is used to cure hyperglycemia. Alkaloids of the plant have hypoglycemic effects via mechanisms of insulin releasing and insulin-mimicking activity and thus improve postprandial hyperglycemia (Patel and Mishra 2011).

Tribulus terrestris L. (Zygophyllaceae) Chota Gokhru. The level of serum glucose could be significantly reduced by saponin from Tribulus terrestris (Li *et al.* 2002).

Withania somnifera (L.) Dunal (Solanaceae) Padalsi. Roots and leaves are used to cure diabetes.

CONCLUSION

Hyperglycemia is generally a chronic disease. Synthetic oral hypoglycemic drugs cause many other side effects. Therefore, herbal drugs are more effective and safe in comparison to them. The Shekhawati area is rich with medicinal flora. Many valuable medicinal plants are found here, used to cure various ailments. But, traditional health care system is restricted now only some.

The Shekhawati region comprises about 26 hypoglycemic plants. Leaves, roots, stem, fruits, flowers, etc. parts are used in hyperglycemia. Some areas of the Shekhawati region are biodiversity rich, such as Shakambhari, Lohargarl, Harshnath, Mansa, Kirodi, etc. Many hypoglycemic plants are wildly grown in these areas. Many plants of them have the capacity to reduce blood sugar level rapidly such as *Azadirachta indica*, *Momordica charantia*, etc. Various plant parts or sometimes whole plant is used as medicine. Karela have been used in India as a folk remedy for diabetes mellitus.

We sincerely thank the people of Shekhawati region which give their important time and help to identify the hypoglycemic flora. We also thank herbal physician or vaidhyas for conformation of hypoglycemic values of selected plants.

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