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Review Article

ETHNO BOTANICAL STUDY OF MEDICINAL PLANTS USED BY TRADITIONAL HEALERS IN THE MANAGEMENT OF DIABETES MELLITUS IN SANKHUWASABHA, NEPAL

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ABSTRACT

Objective: To collect and document information of anti-diabetic plants traditionally used in the treatment of Diabetes Mellitus in Sankhuwasabha district of Nepal as ethno medicines are important part of treatment in this area and such information are considered as valuable sources of information to find new potential drugs.

Methods: Direct observation and interview method with 46 traditional healers along with gathering herbarium specimens mentioned plants in site.

Results: There were 40 medicinal plants from 30 families for the treatment of Diabetes Mellitus. The family with most plant was Fabaceae 5 (16.67 %). Herbal medicines are often used in the form of decoction (45%) and dried powder (33%). It was found that *Momordica charantia* Linn. (42.5%) and *Syzygium jambos* Lam. (40%) were two most frequently used plants among traditional healers for the treatment of Diabetes.

Conclusions: Based on the current findings many of the mentioned plants could have potential active ingredients to influence Diabetes Mellitus and could provide preliminary data for further phytochemical investigations which could possibly lead in the development of novel drugs with little or no side effects and transferring it to future generation. Furthermore, such practical ethno botanical knowledge which is generated based on their intimate experience accumulated over many generations could be helpful in rescuing disappearing knowledge and invention of new drugs of many diseases.

KEYWORDS: Ethno medicine, Diabetes Mellitus, Traditional healers, *Sankhuwasabha*.

INTRODUCTION

Diabetes mellitus is one of the most prevalent diseases in the modern era affecting the citizen of both developed and developing countries [1]. Type I diabetes mellitus is caused by insulin secretion deficit while type II diabetes mellitus is accomplished with progressive rate of insulin resistance in liver and peripheral tissues, reducing β-cell mass, deficient insulin secretion and excessive or inappropriate glucagon secretion[2,3]. Diabetes is associated with long term damage such as malfunction of eyes, kidneys, nerves, heart and blood vessels. Diabetes mellitus is the major endocrine disorder, responsible for renal failure, blindness or diabetic cataract, poor metabolic control, increased risk of cardiovascular disease including atherosclerosis and AGE (Advanced Glycation End) products [4, 5].

Diabetes inflicts more than 100 million people yearly and is recognized as seventh leading cause of death in the world [6]. The international diabetes Federation predicts that the number of people living with diabetes will rise from 366 million in 2011 to 552 million by 2030[7]. In 2014, the prevalence of diabetes is of 8.5% among the adult population. Over the past decade, diabetes prevalence has risen faster in low- and middle-income countries than in high-income countries. The top two countries in number of people with diabetes are currently India and China. As Nepal lies in between these two countries, it is at highest risk [8].

The essential and effective drugs for diabetes mellitus are hypoglycemic agents and insulin injections. But these drugs possess several side effects. Definitive treatment has not been found till date and it has never been reported that someone had recovered totally from Diabetes [9]. Despite considerable progress in the treatment of diabetes, search for newer drugs continuous because existing drugs have limitations. Medicinal plants are good sources as alternative or complementary treatments for this disease as plants have always been an exemplary source of drugs and many of currently available drugs have been derived directly or indirectly from them. World Health Organization has announced that more than 80% of people around the world use herbal medicine at initial level of health remedy (www.fao.org). Herbal medicines are commonly used in Nepal and all over the world because of its low side effects, availability, low cost and its effectiveness.

Although various plants have been traditionally used throughout history to reduce blood glucose and improve diabetes complications, there is not enough scientific information about most of them. But Positive effects of many herbal medicines in reducing blood glucose have been already recognized. The ethno botanical studies of traditional herbal remedies used for diabetes around the world have identified more than 1200 species of plants with hypoglycemic activities [10]. In Nepal, Ghimire (2008) reported 1950 species of different medicinal plants are being used and among them some of them are being used to treat diabetes [11, 12]. Currently, there is no exact data on herbal plants that are used to treat Diabetes Mellitus in Nepal.

Nepal as an old civilized country with diverse social and cultural heritage and has an old traditional system of medicine which is rooted for thousand years ago. In Nepal, during early medieval age, Ayurveda Physicians such as *Vaidhyas, Aacharyas, Rishis* etc., used to work as

medicinal practitioners with some of their manuscripts like *Vedas, Samhitas* and *Nighantus* where many herbal preparations are mentioned. Similarly traditional healers such as *Dhamis, Jhakris, Gurus, Amchi, Lama, Gubhajus, Bijuwa, Guruba* etc also treating different kinds of diseases based on herbal medicines from many generations [13]. The present study has been carried out to explore ethno botanical knowledge of the medicinal plants which are used to treat Diabetes Mellitus of tribal areas of Sankhuwasabha district of Nepal. Sankhuwasabha, an eastern district of Nepal is one the places that ethno medicine is popular and has Good Mountain and hilly weather for the growth of medicinal plants. This region is considered as one of the major arsenal of various high value medicinal plants. In this study, I tried to obtain, analyze and document ethno pharmacological data of medicinal plants used in treatment of diabetes mellitus by traditional healers in this district so that it might help for sharing of knowledge, long term sustainable utilization and conservation of those plants.

METHODS

Study area

Sankhuwasabha district is in Province number one in eastern Nepal. The district's area is 3468.17 sq. kilometer with a population of 158742 in 2011. It covers 27°06' N and 27°55' N and 86°57'E to 87°40' E geographical coordinates. The altitude of this district is so diverse that it consists of Mount Makalu (8463 meter) world's fifth tallest mountain to Arun Valley (457 meter) world's lowest altitude valley. Indigenous ethnics are *Kumal, Yakkha, Lohorung, Kulung, Rai, Gurung, Limbu, Vote* and *Newars. Bahun* and *Chhetri* also live in this district. With regards to meteorological information of region and annual humidity condition of soils, the soil moisture in this area under study was xeric and mesic respectively. According to climatic divisions, this region is cold and temperate. The mean annual rainfall is 1754.2 mm, the highest and lowest annual mean temperature is 25° C and 16.5°C respectively. In this area, December and January is coldest and June –July are the warmest months [14].

Method of collecting data

This study was conducted via questionnaire and interview during October 2015 to October 2016 to traditional healers who are considered as unwritten knowledge. Firstly, a full list of traditional healers was obtained from District Ayurveda Health Center, Sankhuwasabha. According to its data, there are 155 traditional healers in Sankhuwasabha. Face to face interview was done to every one of them and46 agreed to cooperate with us. From them, Information was collected on the basis of the questionnaire. The questionnaires consist of personal information and a list of native plants, the used organ parts, its mode of usage and traditional remedy effect.

Then data collected from them were collected and entered in Excel. Also, the frequency of ethno-medicinal use in Sankhuwasabha was calculated via data mentioned by traditional healers. Finally, the data were analyzed using Excel software to present potential medicinal herbs for diabetes mellitus treatment via these data.

The herbarium specimens obtained based on the native herbalist information were also collected from study area. The herbarium samples obtained from data of local traditional healers in the questionnaire were authenticated by a botanist (Pratikshya Shrestha). A herbarium specimen from each plant (Whole or used part) was prepared and deposited in District Ayurveda Health Center, Khandbari, Sankhuwasabha.

RESULTS

In the present study, a total of 40 medicinal plants genera belonging from 30 families for diabetes treatment were identified. The family with anti-diabetic plants includes Fabaceae 5 (16.67%), Amaryllidaceae (6.67%), Gentainaceae (6.67%),Moraceae (6.67%), Poaceae (6.67%) and Rutaceae (6.67%) (Figure 3.).

Leaves (17%) and seed (17%) were most frequently used parts of those plants (Figure 1).

Powder (45%) and Decoction (33%) are the most common form of using (Figure 2.)

The list and information of ethno botanical remedies for diabetes treatment mentioned by traditional healers of *Sankhuwasabha* are presented in Table 1. It Shows that *Momordica charantia* (42.5%), *Syzygium jambos* (40%), *Azadirachta Indica* (35%), *Elaeocarpus granitus* (35%), *Pterocarpus marsupium* (32.5%), *Swertia chirayita* (30%), *Gymnema sylvestre* (27.5%) were the most commonly used species for management of Diabetes (Frequency of Use) by traditional healers.

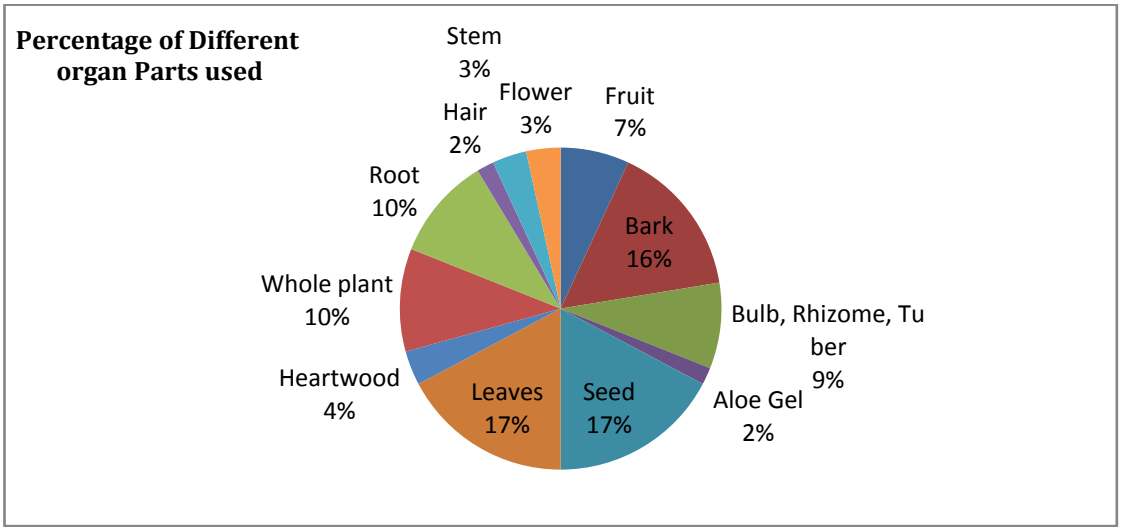

Figure 1.The percentage of different organ part used

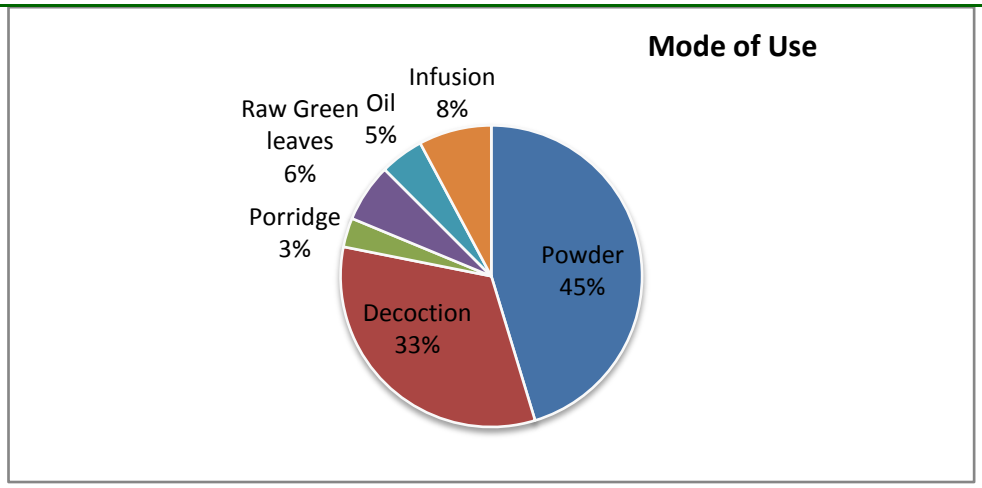

Figure 2.The Percentage of way of using of medicinal plants

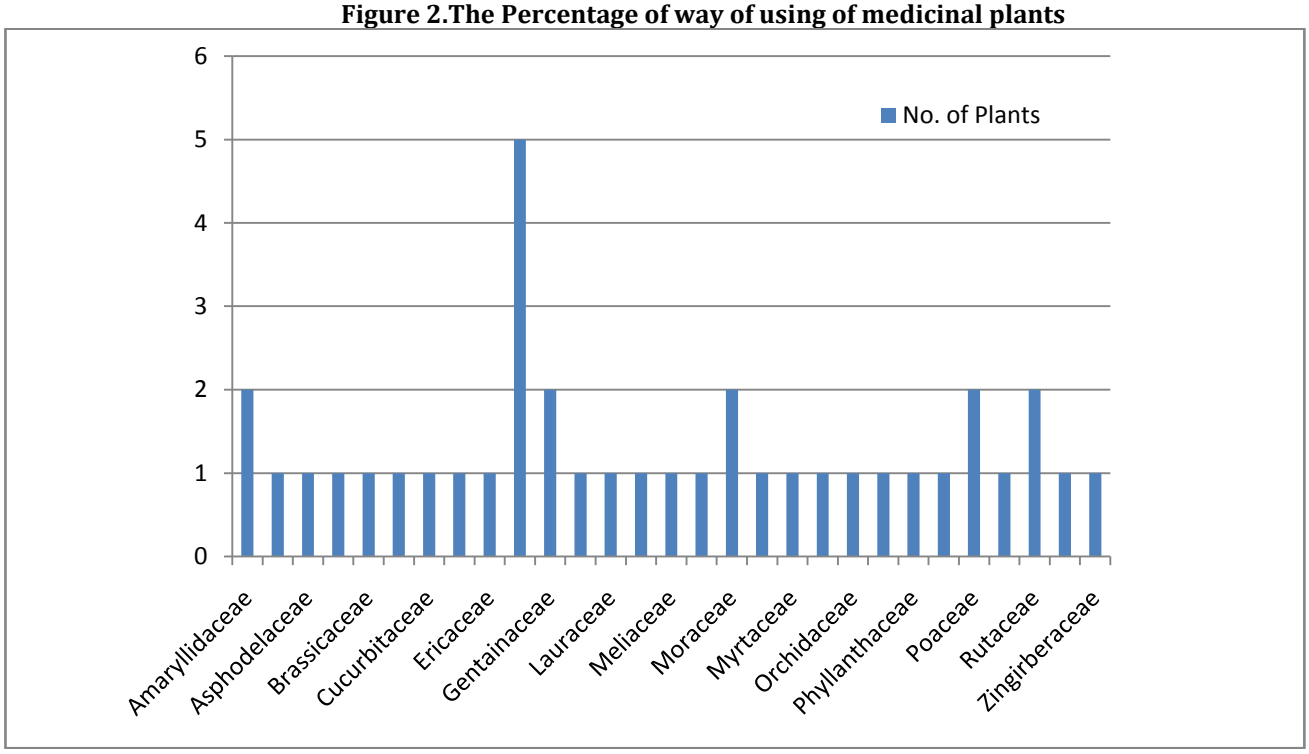

Figure 3. The families and no of plants with anti-diabetic activity included

Table 1: Ethno botanical remedies for treatment of Diabetes in Sankhuwasabha

Scientific name	Family	Nepali Name	English Name	Curative effect	Used Part	Frequency of use	Way Of Using
Aegle marmelos L.	Rutaceae	*Bel*	Golden Apple	Anti-Diarrheal, Anti-diabetic, Anti-Oxidant	Fruit, Bark	9 (22.5%)	Powder, Decoction
Allium cepa L.	Amaryllidaceae	*Piyaj*	Onion	Anti-Oxidant, Anti-inflammatory, immune-modulator	Bulb	6 (15%)	Infusion
Allium sativum L.	Amaryllidaceae	*Lasun*	Garlic	Anti-Lipid, Anti-Hypertensive, Anti-diabetic	Bulb	6 (15%)	Infusion
Aloe vera (L.) Burm.f.	Asphodelaceae	*Ghiu Kumari*	Aloe	Anti-Oxidant, Skin diseases, Anti-diabetic	Aloe gel	8 (20%)	Powder
Avena sativa L.	Poaceae	*Jau*	Oat	Blood purifier, Anti-Diabetic, Analgesic	Seed, Glumelle	5 (12.5%)	Porridge, decoction

Azadirachta Indica A. Juss	Meliaceae	*Neem*	Margosa, Neem Tree	Anti-Fungal, Anthelminthic, Anti-diabetic, Anti-bacterial	Bark, Seed, Leaves	14 (35%)	Powder, Decoction
Brassica juncea (L.)	Brassicaceae	*Tori*	Mustard	Analgesic, Anti-diabetic	Leaves, Seed	3 (7.5%)	Green leaves, Oil
Caesalpinia bonduc (L.) Roxb.	Caesalpiniaceae	*Latakaranja*	Fever nut	Anti-Pyretic, Anti-Diabetic	Seed	4 (10%)	Powder
Cedrus deodara (Robx.) G.Don	Pinaceae	*Devdaru*	Deodar cedar	Anti-Fungal, Anti-cancer, Anti-Diabetic	Heartwood	7 (17.5%)	Oil, Decoction
Cinnamomum tamala Nees	Lauraceae	*Tejpaat*	Indian Bay leaf	Anti-Oxidant, Anti-diabetic	Leaf, bark	6 (15%)	Powder, Decoction
Cordyceps sinensis (Berk.)	Ophicordycipitaceae	*Yarsagumba*	Caterpillar fungus	Aphrodisiac, Tonic,	Whole plant	5 (12.5%)	Powder
Curcuma longa L.	Zingirberaceae	*Besaar*	Turmeric	Anti- Bacterial, Anti-Fungal, Anti-diabetic	Rhizome	9 (22.5%)	Powder
Dactylorhiza hatagirea (D.Don) Soo	Orchidaceae	*Panchaule*	Marsh Orcid	Tonic, anti-ulcerogenic, anti-diabetic, Aphrodisiac	Tuber	8 (20%)	Infusion, powder
Elaeocarpus granitus Roxb. ex G.Don	Elaeocarpaceae	*Rudraksha*	Blue Olive berry	Anti-Microbial, anti-ulcerogenic, Anti-Diabetic, Anti-Depressant	Bark, Fruit	14 (35%)	Powder, Decoction
Enicostemma littorale blume	Gentainaceae	*Naahi*	White head	Anti-diabetic, Anti-oxidant, hepato-protective	Leaves, roots	4 (10%)	Decoction
Ficus bengalensis L.	Moraceae	*Bar*	Banyan	Anti-Diabetic, Anti- Rheumatic	Leaves, Bark	4 (10%)	Decoction
Ficus racemosa	Moraceae	*Dumri*	Fig	Wound healing, Anti-diabetic	Bark, root	3 (7.5%)	Powder
Glycecyrrhiza glabra L.	Fabaceae	*Jethimadhu*	Liquorice	Anti-microbial, anti-inflammatory, Anti-diabetic, Hepatoprotective	Rhizome	7 (17.5%)	Powder, Decoction
Glycine max (L.) Merr	Fabaceae	*Bhatamas*	Soyabean	Anti-Diabetic	Seed	3 (7.5%)	Powder
Gymnema sylvestre R.Br.	Asclepiadaceae	*Gudmaar*	Periploca of the woods	Anti-diabetic, weight loss	leaf	11 (27.5%)	Powder, Decoction
Lagerstroemia speciosa L.	Lythraceae	*AsareFul*	carpe myrtle	Anti-diabetic	Bark, leaves	2 (5%)	Powder, Decoction
Momordica charantia Linn.	Cucurbitaceae	*Karela*	Bitter gourd	Anti-diabetic	Fruit	17 (42.5%)	Powder, Decoction
Moringa olifeira Lam	Moringaceae	*Sigru*	Drumstick tree	Anti-Microbial, Renal tonic	Bark, leaves	8 (20%)	Powder, Decoction
Mucuna Puriens (L.) DC	Fabaceae	*Kapikachhu*	Velvet bean	Anti-Parkinsion, Toxin antagonist, Anti-diabetic	seed, Root, hair	5 (12.5%)	Powder, decoction
Murraya koenigii (L.) Sprengel	Rutaceae	*Mithaneem*	Curry Tree	Anti-Oxidant, Anti-nociceptive, Anti-Diabetic	Leaves, seed	12 (30%)	Oil, Powder, green leaves
Ocimum sanctum L.	Lamiaceae	*Tulasi*	Holy Basil	Anti-fertility, anti-cancer, anti-diabetic, anti-microbial	Whole plant	8 (20%)	Green leaves, powder
Oxalis	Oxalidaceae	*Chariamilo*	Sorrel	Blood purifier	Whole	4 (10%)	Green

corniculata L.					plant		leaves, Decoction
Paspalum scrobiculatum L.	Poaceae	*Millet*	Kodo	Anti-Oxidant, anti-Diabetic	Seed	6 (15%)	Porridge
Phyllanthus embolic L.	Phyllanthaceae	*Amala*	Gooseberry	Rejuvenative, Anti-Oxidant, , Anti-diabetic, anti-Infertility	Fruit	6 (15%)	Powder, Decoction
Pterocarpus marsupium Roxburgh	Fabaceae	*Bijayasaal*	Kino Tree	Anti-diabetic, Anti-Lipid	Heartwood	13 (32.5%)	Powder, Decoction
Rhododendron ferrugineum L.	Ericaceae	*Laliguras*	Rhododendron	Anti-hypertensive, Anti_diabetic	Bark, Leaves, Flower	10 (25%)	Powder, Decoction
Rubia cordifolia L.	Rubiaceae	*Manjistha*	Madder	Anti-inflammatory, ulcer Healing	Whole plant	4 (10%)	Decoction
Saussurea costus (Falc.) Lipsch.	Asteraceae	*Kuth*	Costus	Anti-Hyperlipidaemia,	Root	1 (2.5%)	Powder, Decoction
Swertia chirayita (Roxb, ex Fleming)	Gentianaceae	*Chiraito*	Chirata	Anti-Diabetic, Anti-Pyretic	Whole plant	12 (30%)	Powder, Infusion
Syzygium jambos Lam	Myrtaceae	*Jamun*	Rose apple	Anti-Cancer, Analgesic, Anti-diabetic	Fruit Seed	16 (40%)	Powder, Decoction
Tinospora cordifolia miers	Minispermacea	*Gurjo*	Gulancha Tinospora	Anti-Pyretic, Anti-diabetic, Anti- cancer, Anti-Gout	stem, root	8 (20%)	Infusion
Tribulus terrestris L.	Zygophyllaceae	*Gokshur*	Puncture Vine	Uro-Genital tonic, Aphrodisiac, Renal Tonic	Stem, Root	6 (15%)	Powder
Trigonella foenum gracum Linn.	Fabaceae	*Methi*	Fenugreek	Anti-diabetic, Anti-Dysmenorrhoea	Seed	10 (25%)	Powder
Urtica dioca L.	Urticaceae	*Sisno*	Nettle	Diuretic, Blood purifier, Anti-Diabetic	Whole plant	10 (25%)	Powder, Decoction
Woodfordia fructicosa	Lyrthaceae	*Dhairo*	Fire Flame bush	Wound healing	Flower	6 (15%)	Powder, Decoction

DISCUSSION AND CONCLUSION

Currently, there is no data on medicinal plants used to treat Diabetes in Nepal. Therefore, these findings could be important in the management of Diabetes and future study on traditional medicine in drug development. A current finding shows traditional healers of Sankhuwasabha are using many medicinal plants to reduce hyperglycemia. *Momordica charantia* (42.5%), *Syzygium jambos* (40%), *Azadirachta Indica* (35%), *Elaeocarpus granitus* (35%), *Pterocarpus marsupium* (32.5%), *Swertia chirayita* (30%), *Gymnema sylvestre* (27.5%) were the most commonly used species for management of Diabetes. Dried Powder and decoction are most common form of use. Such herbal medicines are mostly used in rural areas because of availability of lavish amount of medicinal plant in these areas. Therefore these plant derived medicines which are assessable and do not require laborious pharmaceutical synthesis seems highly attractive. As allopathic medicines are not 100% effective in treating the disease and have various side effects, such plant derived medicines could be a good alternative in treatment of diabetes. One of the most significant research scopes is their disease changing effect, i.e., the efficacy of herbal medicines in preventing diabetes progress, which requires doing experiments on mechanisms, herbal medicines efficiency and safety as well as useful part used in diabetes disease remedy.

The major drawbacks currently found in using these medicinal herbs are there are no scientific systems of identifying, collecting and regenerating these plants. Several such high yield plants have are in risk of lost or being endangered. In this scenario, handling of medicinal biodiversity should involve an integrated approach comprising of well documentation, their sustainable utilization and conservation. Many new bioactive drugs isolated these plants could be equal or more potent than known hypoglycemic agents so better care must be taken now. Traditional healers are also using some mineral preparations such as Shilajeet in the treatment of Diabetes where further more study can be done. The wealth of Knowledge of tribal people about medicinal plants around

them for primary health care is diminishing over the period. Efforts should be taken to conserve the knowledge wealth and usage of medicinal plants should be promoted in such areas.

To sum up, these probable anti-diabetic medicinal plants that are being used in Sankhuwasabha may be useful to the health professional, scientists and scholars working in the field of Pharmacology, Ayurveda and other therapeutics to develop anti diabetic drugs. However, many other investigations and research must be carried out to evaluate the mechanism of action pharmacologically of these medicinal plants. The toxic effect of these plants should also be elucidated.

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