Survey on Medicinal Plants used for Anti-diabetic Activity in Kaski District, Nepal

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ABSTRACT

Nepal is a Himalayan country with disproportionately rich cultural and ethnic diversity, recorded of over 700 species of medicinal plants. Most of the people in rural area rely on herbal medicines to treat diabetes mellitus since they have limited resources and do not have access to modern treatment. The main aim of the study was to search the medicinal plants used for diabetes mellitus for the development of evidence based medicine. The study was conducted in five different places of Kaski District, Nepal with two hundred numbers of respondents. It was found that majority of them had good knowledge on traditional use of the plants for diabetes and had been using 52 plant species of 35 families in which *Asparagus racemosus, Momordica charantia, Berberis aristata, Azadiracta indica, Holorhena pubences, Eugenia jambolana, Aegle marmelous* and *Gymnema sylvestre* are the most widely used plants for anti-diabetic purposes.

Key words: Diabetes Mellitus, Medicinal Plants, Kaski District, Survey, Respondents

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INTRODUCTION

Natural products have played an important role in the treatment of various diseases and in drug discovery processes for thousands of year. The ancient civilizations of the Chinese, Indians and North Africans provide written evidence for the use of natural sources for curing various diseases. It has remained a source of new compounds with diversified structural arrangements possessing interesting biological activities. The earliest known written document is a 4,000 year old Sumerian clay tablet that records remedies for various illnesses. For instance, mandrake was prescribed for pain relief, turmeric possesses blood clotting properties, roots of the endive plant were used for treatment of gall bladder disorders and raw garlic was prescribed for circulatory disorders. These are still being used in several countries as alternative medicines. Friedrich Sertürner isolated morphine from *Papaver somniferum* in 1806 and since then natural products have been extensively screened for their medicinal purposes. Atropine from *Atropa belladonna*, strychnine isolated from *Conus magus*, and Taxol obtained from the bark of the Pacific yew tree are a few examples of active isolated compounds from natural sources[1].

It is estimated that more than 25% of all current prescription drugs are derived from plants. Among the drugs developed over past 25 years, 5% were natural products, 27% were derivatives of natural products and 30% were synthetic drugs inspired by natural products. The most successful story of the discovery of the anti-diabetic drugs from natural products is metformin. Its parent compound is natural guanide originally purified from the plant *Galegine officinalis*[2].

Despite competition from other drug discovery methods, natural products are still providing their share of new clinical candidates and drugs. These compounds are still a significant source of new drugs, especially in the anticancer, antihypertensive, anti-infective, immune suppression and neurological disease therapeutic areas and some of them have since progressed further into clinical trials or into the market. Therefore, in addition to being a proven and important source of drug leads, natural products derived drugs also contribute significantly to the profitability of many companies. A natural product is a chemical compound or substance produced by a living organism found in nature that usually has

a biological activity for use in pharmaceutical drug discovery and drug design. A crude extract from natural product contains novel, structurally diverse chemical compounds. Not all natural products can be fully synthesized and many natural products have very complex structures that are too difficult and expensive to synthesize on an industrial scale. These include drugs such as penicillin, morphine and formerly paclitaxel. Such compounds can only be harvested from their natural source a process which can be tedious, time consuming, and expensive as well as being potentially unsustainable for the resource[3].

Nepal is a Himalayan country with disproportionately rich cultural and ethnic diversity, lies in the temperate zone with an added advantage of altitude from 1220 to 8848 m above mean sea level, except for a few places that lie below 1220 m. The diversity of species in Nepalese flora offers great opportunities for the search of medicinal substances, not yet described or discovered. Nepal has a record of over 700 species of medicinal plants. There is a store of still unwritten and undocumented traditional knowledge on the use of plants for healing purposes. To sustain and perpetuate folk medicine systems to provide primary health care for the majority of inhabitants in the rural area, medicinal plants are bound to play pivotal role[4].

Diabetes mellitus (DM) is considered as a major health risk in the world caused by the deficiency of effective insulin in the body. It causes the disturbance of metabolism of carbohydrate in body. This results in hyperglycemia (excessive sugar in the blood) and glycosurea (presence of sugar in the urine). Some other symptoms associated with disease are polydipsia (increased thirst), polyurea (increased urinary output), ketonemia and ketonurea (presence of ketone bodies in the blood and urine, respectively). As the disease progresses tissue or vascular damage ensues adding to severe diabetic complications such as retinopathy, nephropathy, neuropathy and ulceration, thus diabetes mellitus is a chronic and progressive conditions associated with serious micro vascular and macro vascular complications[5].

WHO has listed 21,000 plants for medicinal purposes around the world. Among them, 800 plants have been reported to show antidiabeticpotential. The pharmacological actions of plant materials typically result from the combination of secondary metabolites present in the plant like polyphenols, flavonoids, alkaloids, tannins, saponins, volatile oils, etc. which are known as phytochemicals[6]. Phytochemicals exert their effect by resembling endogenous metabolites, ligands, hormones, signal transduction molecules or even neurotransmitters.

Most of the people in developing countries rely on herbal medicines to treat diabetes mellitus since they have limited resources and do not have access to modern treatment. Several compounds derived from these herbal medicines are in use for various kinds of disease and disorders. Another important factor that supports the use of plant materials as antidiabetic could be due to the belief that herbs provide some benefits over allopathic medicine and allow the users to take medications of their choice[7]. Therefore, the aim of the study was to search the medicinal plants used by local people for the treatment of diabetes.

MATERIALS AND METHODS

Study Area

Kaski District (83°40' east to 84°12' East longitude and 28°06' north to 28°36' North latitude) which is a historical and twenty third largest densely populated density district of the country was selected for the study. The total area of the district is 2017 sq.km. Different types of climate like sub-tropical, temperate, temperate cold, alpine and tundra is found in Kaski district. The Maximum rainfall was recorded as 701.7 mm in 2009 August and similarly, the maximum temperature was recorded 32°C in summer and 2.2°C in winter season. The temperature is always influenced with variation in altitude.

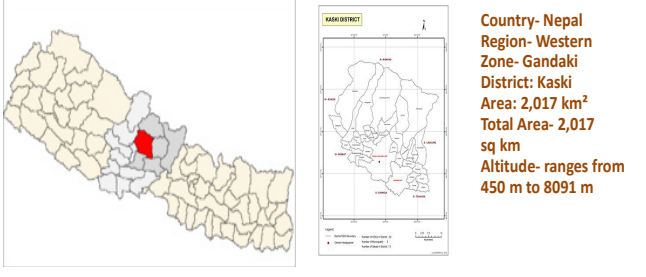

Figure 1: Location map of Kaski District Source: http:// ganthan.com/kaski-district-map/

Study Design

Survey was conducted to investigate anti-diabetic medicinal plants used by local people in Kaski District during different periods of year 2015-2016. 200 peoples from different five places (Gandruk, Hemja, Lamachour, Khudi and Kotre) were selected and information regarding the antidiabetic medicinal plants was collected through questionnaire and personal interviews. A verbal consent from the respondents was taken before the study.

RESULTS AND DISCUSSION

A list of plant species along with their local name, scientific name, family name, parts used and methods of uses is given below in Table 1. The investigation revealed 52 plant species belonging to 35 families are being used to cure diabetes. It was also found that people from any occupation and age above 25 years used medicinal plants to cure diabetes. In the local market of Kaski district it was found that major component of herbal and ayurvedic formulation for antidiabetic purposes being used were A*sparagus racemosus*, *Momordica charantia*, *Berberis aristata*, *Syzygium cumini, Aegle marmelous,* and *Gymnema sylvestre*. During survey, it was found that *Momordica charantia* (16%), A*sparagus racemosus* (14%), *Aegle marmelous* (13%)*, Berberis aristata* (11%), *Holorhena pubences* (12%)*, Eugenia jambolana* (12%)*, Azadiracta indica* (12%) and *Gymnema sylvestre* (10%) were the most widely used plants for diabetics. These plants are consumed either in the form of juice, powder or boiled extract of leaves, roots, seed, fruits, bark and flower. Regarding all identified plants, leaves and seeds were the major plant parts used, which is in agreement with other studies[8].

About sixteen percent of total respondent uses karela (*M. charantia)* for the treatment of diabetic and this indigenous knowledge is supported by various scientific studies. *M. charantia* have been reported to possess hypoglycaemic activity on streptozotocin induced diabetic rats and suggested that oral feeding of fruit juice may have a role in the renewal of β cell in STZ diabetic rats or alternately may permit the recovery of partially destroyed β cell[9].

A. indica commonly known as neem is an indigenous plant widely available in Nepal. In this study about twelve percent of total respondent used *A.indica* for the treatment of diabetic which is also supported by various scientific studies. Effect of *A. indica* leaf extract on serotonin inhibition in glucose mediated insulin release in rat pancreas was studied in vitro to elucidate the possible mechanism of antihyperglycemic effect[10]. In another study it was shown that hydroalcoholic extracts of this plant has antihyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemi diaphragm[11].

Ethanolic extract of dried seed of *E. jambolana* has been reported to have antidiabetic effects on streptozotocin induced diabetes. Extract was given orally and showed dose dependent decrease in blood glucose level in diabetic rats[12]. The leaf extract of *G. sylvestre* was demonstrated to possess a significant antidiabetic activity in alloxan induced and normal fasting rats in 30-day chronic studies. *G. sylvestre* crude extracts and its isolated compound, dihydroxy gymnemic triacetate, also exhibited hypoglycemic effect against streotozotocin induced diabetic rats[13]. A significant decrease in liver glycogen of diabetic rats is reversed to almost the normal level by the leaf extract of *A. marmelous* and it also decreases the blood urea and serum cholesterol. A similar effect is seen with insulin treatment and the results indicate that the active principle in *A. marmelos* leaf extract has similar hypoglycemic activity to insulin treatment[14]. *A. racemosus* root has previously been reported to reduce blood glucose in rats and rabbits. Study of the effects of the ethanol extract and five partition fractions of the root of *A. racemosus* were evaluated on insulin secretion together with exploration of their mechanisms of action. The ethanol extract and each of the hexane, chloroform and ethyl acetate partition fractions concentration-dependently stimulated insulin secretion in isolated perfused rat pancreas, isolated rat isletcells and clonal β cells[15]. Ethanolic extract *B. aristata* produced significant antihyperglycemic activity in streptozotocin induced diabetic rat which is comparable to metformin[16].

In such a way the most frequently used anti-diabetic medicinal plants in Kaski District is

supported by the various scientific studies as well. There is an urgent need to explore and document the ethnomedicinal plants used by different communities of Kaski District before such knowledge vanishes. As indigenous knowledge on usages of medicinal plants is transmitted without any systematic process and younger generation of communities are not interested in traditional healing system as it has no or very little scope for income. Thus, it becomes necessary to acquire and preserve this traditional system of medicine by documentation and identification of specimens.

Table 1: A list of plant species along with their local name, scientific name, family name, parts used and methods of uses.

S.No.	Local Name	Scientific Name	Family	Parts used	Method of use and administration
1.	Gheu Kumari	*Aloe vera*	Asphodelaceae	Leaves	Latex of leaves juice
2.	Parijat	*Nyctanthes Arbortritis*	oleaceae	Twig and flower	juice from 7 pieces of twigs or flower with water
3.	Amba	*Pisidum gujava L.*	Myrtaceae	Leaves, fruit, twig	Juice of leaves,fruit
4.	Tulsi	*Ocimum tenuiflorum*	Lamiaceae	Leaves	Eating raw leaves, decoction
5.	Kurilo	*Asparagus racemosus*	Liliaceae	Twig,stem	Eating like soup of twig
6.	Bindi	*Abelmoschus esculentus*	Malvaceae	Fruit	1 glass juice empty stomach
7.	Karela	*Momordica charantia*	Cucubitaceae	Fruit	Juice of fruit, vegetable
8.	Neem	*Azaricta indica*	Meliaceae	Juice of leaves	Leaves
9.	Tite pati	*Artemisia vulgaris*		Leaves	2,3 green leaves are chewed
10.	Asuro	*Justicia adhatoda*	Acanthaceae	Leaves	1 glass of juice from leaves
11.	Chutro	*Berberis aristata*	Berberidaceae	Roots	Root of chutro is soaked in water and that water is taken next morning, 2 times a day.
12.	Kera	*Musaparadisiaca*	Musaceae	Fruit	Raw babana is eaten
13.	Sisno	*Girardiana diversifolia*	Urticaeceac	Growing buds	Growing buds are dried and powdered and taken by mixing with water
14.	Chinijhar	*Scorparia dulcis*	Scrophulariaceae	whole plant	Drinking juice by crushing whole plant
15.	Jamun	*Syzygium cumini*	Myrtaceae	Fruit, seed	Eaten fruits and even the seeds
16.	Methi	*Trigonella foenum graecumlinn*	Fabaceae	Seed	Seeds are soaked in water and eaten

17.	Gudmaar	*Gymnema sylvestre*	Asclepiadaceae	Leaves	leaves are eaten
18.	Amala	*Phyllanthus emblica*	Euphorbiaceae	Fruit	Chew fruit
19.	Gahu	*Triticum vulgare*	Graminaceae	Nal	Nal is boiled and water is drank
20.	Chiraito	*Swertia chirayita*	Gentianaceae	Root	root is soaked in water and that water is drink next morning
21.	Satuwa	*Paris polyphylla san*	Liliaceae	Whole plant	Crushed and taken
22.	Ukhu	*Saccharum offinarum*	Poaceae	Stem	Juice
23.	Dhobini	*Mussaenda macrophylla*	Rubiaceae	Root	Root juice
24.	Harro	*Terminalia chebula*	Combretaceae	Fruit	Dried fruits are eaten
25.	Barro	*Terminalia bellirica*	Noctuidae	Fruit	Dried fruits are eaten
26.	Lapsi	*Choerospondias axillaris*	Anacardiaceae	Fruit	Chew fruits
27.	Indrajau	*Hollarhenna pubecens*	Apocynaceae	Seed, leaf	Seeds chewed directly, decoction of leaves
28.	Bel	*Aegle marmelos*	Rutaceae	Fruit	Juice of fruit
29.	Aduwa	*Zingiber officinalis*	Zingiberaceae	Root	Juice of roots, mixed with curry and decoction
30.	Pharsi	*Cucurbita mixta*	Cucurbitaceae	Fruit	Eaten as vegetable, boiled fruit is eaten
31.	Laliguras	*Rhododendron arboneum*	Ericaceae	Flower, leaves	flower is eaten
32.	Pakhanbed	*Bergenia ciliate*	Taxaceae		
33.	Rajbriksha	*Cassia fistula*	Fabaceae	Fruit	Fruit pulp is eaten.
34.	Kyamuna	*Cleistocalyx operculatus*	Myrtaceae	Bark	
35.	Sal	*Shorea robusta*	Dipterocarpaceae	Seed	Seed are eaten
36.	Siplikan	*Crateva unilocularis*	Capparaceae	Leaves	Decoction, as curry
37.	Koiralo	*Bauhinia variegate*	Leguminosae	Flower	As curry, decoction of flower
38.	Ajammari	*Kalanchoe spathulata*	Crassulaceae	Leaves	Decoction, juice
39.	Makai	*Zea mays*	Poaceae	Fruits	Eaten boiled maize, dried maize rice
40.	Gurjo	*Tinospora cordifolia*	Menispermaceae	Whole plant	Decoction of leaves, roots are used

41.	Akbarekhursani	*Capsicum annuum L.*	Solanaceae	Fruits	Eaten raw or in dried form mixed with curry
42.	Kodo	*Origanum vulgare*		Seed	Eaten dhido, roti
43.	Phapar			Seed	Eaten dhido, roti
44.	Thakailo	*Cirsium verutum*		Root	Roots are crushed and the juice is taken
45.	Kubija				
46.	Kutki	*Picrorrhiza kurroa*	Scrophulariaceae		
47.	Simali	*Vitex nigundo*	Labitaceae	Whole plant	Leaves are crushed and juice is taken
48.	Marathi	*Acmella calva*	Compositae	Whole plant	
49.	Bhuiamala	*Phyllanthus virgatus*	Euphorbiaceae	Fruit	Fruit is chewed
50.	Kantakari				
51.	Lasun			Whole plant	Leaves, roots are eaten
52.	Datiwan	*Achyranthes aspera*	Amaranthaceae	Whole plant	Decoction of the leaves are used

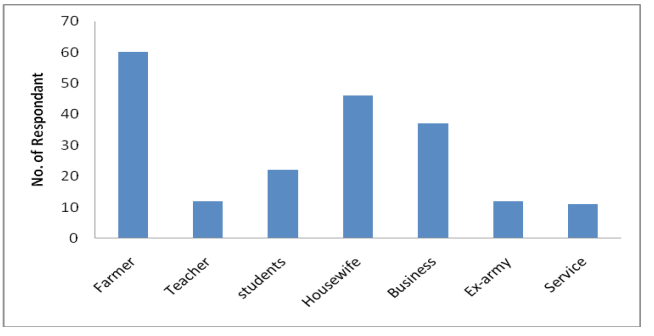

Figure 2: Personal status of respondent: Data are presented as no. of respondents with their occupations.

Table 2 : More frequently used medicinal plant by local people

Scientific Name	Local name of Plant	% of respondents
Momordica charantia	Karela	16.00%
Azadiracta indica	Neem	12.00%
Asparagus racemosus	Kurilo	14.00%
Aegle marmellous	Bel	13.00%
Holorhena pubences	Indrajau	12.00%
Gymnema sylvestre	Gudmaar	10.00%
Berberis aristata	Chutro	11.00%
Eugenia jambolana	Jamun	12.00%

CONCLUSION

Among 52 plant species of 35 families, Asparagus racemosus, Momordica charantia, Berberis aristata, Azadiracta indica, Holorhena pubences Eugenia jambolana Aegle marmelous and Gymnema sylvestre are the most widely used plants for anti-diabetic purposes.

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