ETHNO BOTANICAL SURVEY OF MEDICINAL PLANTS USED FOR THE TREATMENT OF HYPERTENSION IN SANKHUWASABHA, NEPAL

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ABSTRACT

Objective: Hypertension is one of the major public health problems in Nepal. The study was aimed at surveying the Ethno botanical plants used traditionally to cure HTN in Sankhuwasabha District of Nepal. **Methods:** Administration of structured questionnaires and face to face interview was employed. Herb sellers, traditional healers/ practitioners, local farmers and aged people were the respondents. Plant species were photographed and identified at the District Ayurveda Health Center, Khandbari, Sankhuwasabha. **Results:** A total number of 38 plants species belonging to 32 families were observed to be used in treatment of Hypertension. The family with most plant was Amaryllidaceae, Apocynaceae, Cucurbitaceae, Fabaceae, Meliaceae and Zingiberaceae with two plants in each family. The other plant families have one member each in the distribution of species within the families. It was found that *AzadirachtaIndica* (57.9%), *Nyctanthesarbortristis* (55.23%), *Elaeocarpusgranitus* (52.6%), *Momordicacharantia* (49.97%), *Swertiachirayita* (44.71%), were five most frequently used plants among traditional healers for the treatment of hypertension. **Conclusion:** Based on the current findings many of the mentioned plants could have potential active ingredients to influence Hypertension 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 including Hypertension.

Keywords: Ethno botanical survey, Medicinal plants, Hypertension, Sankhuwasabha

INTRODUCTION

The term ethno botany was first coined by an American botanist John Harshburger, in 1896, in an attempt to study the plants used by the primitive and aboriginal people. Ethno botany is defined as the scientific study of traditional knowledge of indigenous communities, about surrounding plant diversity and how various people make use of indigenous plants found in their localities for food, clothing and medicine[1].Plants are significant sources of medicines that are used in the treatment of various categories of human diseases. Historically all medicinal preparations were derived from plants, whether in the simple form of plant parts or in the more complex form of crude extracts, mixtures, etc.[2]. Plants have been described as the sleeping giants of drug and these medicinal plants have been screened for their chemicals that are potentially potent as medicine. In the developed countries 25% of the medical drugs are based on plants and their derivatives[3]. A substantial number of drugs are developed from plants which are active against number of diseases. The majority of these involve the isolation of the active ingredient (chemical compound) found in a particular medicinal plant and its subsequent modification[4]. Some phytochemicals have advantageous effects on long term health when humans consume them and can be used effectively to treat human disease. Many Medicines that are currently being used are derived from plants. Examples are insulin (from root of dahlias), quinine (from cinchona), morphine and codeine (from poppy), theophylline (from tea) and dioxin (from foxylove) [5].

Hypertension

Hypertension (HTN) is the term used to denote elevated blood pressure. It is defined as the condition in which the blood pressure remains consistent to Systolic Blood Pressure (SBP) > 140mm Hg and Diastolic Blood Pressure (DBP) > 90mm Hg [6]. It is a precursor to major diseases like myocardial infarction, stroke, renal failure etc. Globally, nearly one billion people have high blood pressure (hypertension); of these, two-thirds are in developing countries. Hypertension is one of the most important causes of premature death worldwide and the problem is growing; in 2025, an estimated 1.56 billion adults will be living with hypertension [7].

HTN is one of the major public health problems in Nepal. Here it is an "iceberg" condition and the prevalence of HTN has been considered as an increasing "silent killer" problem along with rapid urbanization [8]. High blood pressure is called "the silent killer" because it usually has no symptoms. Some people may not find out they have it until they have trouble with their heart, brain, or kidneys. Arterial HTN, which is one of the main causes of coronary vascular disease, is responsible for nearly 20% of all deaths worldwide (nearly 10 million). These are the principal cause of death in all developed countries accounting for 50% of all deaths and are also emerging as a prominent public health problem in developing countries, ranking third with nearly 16% of all deaths [9]. High blood pressure is a risk factor for death from cardiovascular causes such as heart attacks, heart failure, and stroke, but also from kidney failure and blood vessel disease [10, 11, 12, 13, 14] with proper treatment

however, this risk can be reduced. In randomized controlled studies of drug treatment of HTN, one-third reduced stroke mortality, whereas one-fourth reduced mortality from coronary artery disease [15].

There are many potential causes of hypertension, but sometimes the disease is asymptomatic. The risk factors for hypertension include aging populations and adverse changes in risk factors such as tobacco use, low physical activity and high salt consumption [16].Although the rate of hypertension is rising in developed countries, the rate increases even faster in low and middle income countries like Nepal. Studies done in Nepal have reported a prevalence of hypertension ranging from 18.8% to 41.8% [17] and some other study shows that Prevalence of hypertension in Nepalese community triples in 25 years [18]. According to WHO, 80% of people are still using some form of traditional medicine in the management of their diseases. From this, we can assume the importance of indigenous traditional knowledge in the management of Hypertension as 20% of people around the world are considered to be Hypertensive. In Nepal, 1950 species of different medicinal plants are being used and among them some of them are being used to treat Hypertension [19]. Till date, there is no any data of traditional ethno botanical knowledge in management of Hypertension in Nepal.

Currently, there is the danger that the knowledge of herbal medicine may die along with the aging generation of herbal medical practitioners [20]. Therefore, the need to document and preserve the knowledge through ethnobotanical survey is justified. Therefore, in this paper; we provide report on the medicinal plants used by the people of Sankhuwasabha, Nepal in management of hypertension.

METHODS

Study area

The Survey Area was Sankhuwasabha district of Nepal. 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 [21].

Map of Sankhuwasabha District

Methods, Data Collection

This study was conducted via questionnaire and face to face interview during February 2016 and November 2016 to obtain information about medicinal plants used for the management of hypertension. Firstly, a full list of traditional healers (which includes *Dhamis, Jhakris, Vaidayas, Gurus, Lamas, Amchis, Jharfuke, Bijuwa* etc.) was obtained from District Ayurveda Health Center, Sankhuwasabha. According to its data, in 2014/2015 there are 155 traditional healers in Sankhuwasabha. Face to face interview was done to every one of them and among them 48 agreed to cooperate with us. From them, the information was gathered based on oral interview and also with the aid of structured questionnaire. Data only from willing respondent were documented. Each one was interviewed once. During the course of this survey, a camera was used to take the pictures of the identified plants. A field note and pen was also used for writing the common names, description, local names and uses of the plants mentioned by respondents.

The herbarium specimens obtained based on the traditional healer's 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 (*PratikshyaShrestha*). A herbarium specimen from each plant (Whole or used part) was prepared and deposited in District Ayurveda Health Center, Khandbari, Sankhuwasabha.

Then data collected from them were collected and entered in MS-Excel. Finally, the data were analyzed using Excel software to present potential medicinal herbs for treatment of Hypertension. Charts and tables were used to summarize the data.

RESULTS

Results of the demographic structure (Table 1) of respondents in Sankhuwasabha District revealed that 25 of the respondents were mainly *Dhamis* and *Jhakri* (Shaman) and 9 were herb sellers. Majority respondents were male (31) and only few were females (17).The result also showed that most knowledge on herbal remedies is handed down by older members of the community (41-60 and 60 plus years of age).

The professional experience of respondents as observed in Table 2; shows that 28 of them inherited this knowledge from their ancestors while 7 got theirs by training via District Ayurveda Health Center. Similarly result shows that most people were poor academically. Only one respondent had completed bachelor degree. The information gathered from all respondents showed that about 38 plant species from 32 families are used in Sankhuwasabha for treatment of Hypertension. Botanical names, local names, Common English names, habits and frequency ofuse are presented in Table 3. It was found that *AzadirachtaIndica* (57.9%), Nyctanthes*arbortristis* (55.23%), *Elaeocarpusgranites* (52.6%), *Momordicacharantia* (49.97%), *Swertiachirayita* (44.71%), were five most frequently used plants among traditional healers for the treatment of hypertension.

Species distributions according to the families are shown in (Table 4). This study revealed that the family Amaryllidaceae, Apocynaceae, Cucurbitaceae, Fabaceae, Meliaceae and Zingiberaceae has two plants in each family. The

other plant families have just one member in the distribution of species within the families.

Table 5 shows the plant part used, method of preparation as well as administration of recipe used in the treatments of Hypertension. It was observed that recipes are prepared from combination of different parts from two or more plant species including roots, leaves, seeds and stem (bark) and so on. Preparations mostly preferred are by dried powder and decoctions by oral administration.

The 38 medicinal plant species mentioned were represented by all plant forms (Figure 1). Herbs were the most used plants (19) followed by trees (11), shrubs (5) and climber (3).

Root was most commonly used part in preparation of medicine (Figure 2).

Table 1: Demographic structure of respondents in Sankhuwasabha, Nepal

Parameter	Specifications	Number of respondents
Practice Specifications	Herb Sellers	9
	Lamas	2
	Baidhyas	4
	Dhami	16
	Jhakri	9
	Aamchi	3
	Guruba/Guruaama	5
	Total	**48**
Sex	Male	31
	Female	17
	Total	**48**
Age (Years)	1-20	1
	21-40	9
	41-60	14
	>60	24
	Total	**48**

Table 2: Knowledge Source

Parameter	Specification	Number of Respondents
Knowledge Source	Ancestral	28
	Training	7
	Academic	1
	Divination	12
Education	Illiterate	14
	Read and writes	12
	Primary	7
	Lower secondary	6
	Secondary	6
	Plus two	2
	Bachelor	1
	Masters	0

Table 3: List of Plant used for the Treatment of Hypertension In Sankhuwasabha

S.N.	Botanical name	Family	Local Name	English name	Ha-bits	Frequen-cy of use
1.	*Acoruscalamus*L.	Acoraceae	*Bojho*	Sweet Flag	Herb	3 (7.9%)
2.	*Allium sativum*L.	Amaryllida-ceae	*Lasun*	Garlic	Herb	2 (5.3%)
3.	*Allium wallichii*Kunth.	Amaryllida-ceae	*Ban Lasun*	Wild Garlic	Herb	4 (10.5%)
4.	*Aloe vera* (L.)Burm.f.	Asphodelaceae	*GhiuKumari*	Aloe	Herb	2 (5.3%)
5.	*Ananascomosus*(l.) Merr.	Bromeliaceae	*Bhuikatar*	Pineapple	Herb	1 (2.63%)
6.	*Azadirachtaindica*A. Juss	Meliaceae	*Neem*	Margosa, Neem Tree	Tree	22 (57.9%)
7.	*Berberisaristata*L.	Berberidaceae	*Chutro*	Tree turmeric	Shrub	3 (7.9%)
8.	*Boerhaviadiffusa*L.nom.cons.	Nyctaginaceae	*Punarnawa*	Spreading hog-weed	Herb	3 (7.9%)
9.	*Cedrusdeodara (Robx.)* G.Don	Pinaceae	*Devdaru*	Deodar cedar	Tree	2 (5.3%)
10.	*Cinnamomumtamala*Nees.	Lauraceae	*Tejpaat*	Indian Bay leaf	Tree	5 (13.15%)
11.	*Curcuma longa* L.	Zingirberaceae	*Besaar*	Turmeric	Herb	4 (10.52%)
12.	*Dactylorhizahatagirea*(D.Don)Soo	Orchidaceae	*Panchaule*	Marsh Orcid	Herb	7 (18.41%)
13.	*Elaeocarpusgranitus*Roxb. ex G.Don	Elaeocarpa-ceae	*Rudraksha*	Blue Olive berry	Tree	20 (52.6%)
14.	*Elettariacardamomum*(L.) Maton	Zingiberaceae	*Sukumel*	Lesser Cardamo-mum	Herb	2 (5.3%)
15.	*Herpetospermumpedunculosum*(Ser.) Clark	Cucurbitaceae	*Ban Karela*	Bitter gourd	Climb-er	16 (42.08%)
16.	*Hordeumvulgare*L.	Poaceae	*Jau*	Barley	Herb	1 (2.63%)
17.	*Meliaazedarach*L.	Meliaceae	*Bakaino*	Chinaberry tree	Tree	6 (15.78%)
18.	*Mimosa pudica*L.	Fabaceae	*Lajawati*	Touch me not, shy plant	Herb	3 (7.9%)
19.	*Momordicacharantia*Linn.	Cucurbitaceae	*Karela*	Bitter gourd	Climb-er	19 (49.97%)
20.	*Moringaolifeira*Lam	Moringaceae	*Sigru*	Drumstick tree	Tree	4 (10.52%)
21.	*Morusnigra*L.	Moraceae	*Kimbu*	Mulberry	Tree	1 (2.63%)
22.	*Murrayakoenigii*(L.) Sprengel	Rutaceae	*Mithaneem*	Curry Tree	Tree	1 (2.63%)
23.	*Nardostachysjatamansi*(D.Don) DC.	Caprifoliaceae	*Bhutjara, Jatamasi*	Spikenard	Herb	8 (21.04%)
24.	*Neopicrorhizascrophulariifo-lia*(Pennell) Hong	Plantaginaceae	*Kutaki*	Figwort picorhiza	Herb	7 (18.41%)
25.	*Nerium oleander* L.	Apocynaceae	*Kaner, Ba-ramase*	Oleander	Shrub	2 (5.3%)

26.	*Nyctanthesarbortristis*L.	Oleaceae	*Parijaat*	Night Flowering Jasmine	Tree	21 (55.23%)
27.	*Ocimum sanctum* L.	Lamiaceae	*Tulasi*	Holy Basil	Herb	3 (7.9%)
28.	*Phyllanthusembolica*L.	Phyllanthaceae	*Amala*	Gooseberry	Tree	2 (5.3%)
29.	*Rhododendron ferrugineum*L.	Ericaceae	*Laliguras*	Rhododendron	Tree	2 (5.3%)
30.	*Rauvolfia serpentine* (L.)Benth. Ex Kurz	Apocynaceae	*Sarpagandha, Chandmaru-wa*	Snakeroot, Serpentine wood	Shrub	15 (39.45%)
31.	*Rubiacordifolia*L	Rubiaceae	*Manjistha*	Madder	Herb	2 (5.3%)
32.	*Swertiachirayita*(Roxb, ex Fleming)	Gentianaceae	*Chiraito*	Chirata	Herb	17 (44.71%)
33.	*Tinosporacordifolia*miers	Minisperma-cea	*Gurjo*	GulanchaTinospora	Climber	1 (2.63%)
34.	*Tribulusterrestris*L.	Zygophylla-ceae	*Gokshur*	Puncture Vine	Shrub	2 (5.3%)
35.	*Trigonellafoenumgracum*Linn.	Fabaceae	*Methi*	Fenugreek	Herb	8 (21.04%)
36.	*Urticadioca*L.	Urticaceae	*Sisno*	Nettle	Herb	5 (13.15%)
37.	*Valerianajatamansi*Jones	Valerianaceae	*Sugandhawal*	Valerian	Herb	5 (13.15%)
38.	*Withaniasomnifera*(L.)Dunal	Solanaceae	*Ashwogandha*	Winter cherry	Shrub	4 (10.52%)

Table 4. Distribution of Species within the Families

S.N.	Family	Frequency	S.N.	Family	Frequency
1.	Acoraceae	1	17.	Moraceae	1
2.	Amaryllidaceae	2	18.	Moringaceae	1
3.	Apocynaceae	2	19.	Nyctaginaceae	1
4.	Asphodelaceae	1	20.	Oleaceae	1
5.	Berberidaceae	1	21.	Orchidaceae	1
6.	Bromeliaceae	1	22.	Phyllanthaceae	1
7.	Caprifoliaceae	1	23.	Pinaceae	1
8.	Cucurbitaceae	2	24.	Plantaginaceae	1
9.	Elaeocarpaceae	1	25.	Poaceae	1
10.	Ericaceae	1	26.	Rubiaceae	1
11.	Fabaceae	2	27.	Rutaceae	1
12.	Gentianaceae	1	28.	Solanaceae	1
13.	Lamiaceae	1	29.	Urticaceae	1
14.	Lauraceae	1	30.	Valerianaceae	1
15.	Meliaceae	2	31.	Zingiberaceae	2
16.	Minispermacea	1	32.	Zygophyllaceae	1
			33.	**Total**	**38**

TABLE 5: Preparation and Administration Methods of Medicinal Plants used in the treatments of Hypertension

S.N.	Botanical name	Part used	Method Of Administration
1.	*Acoruscalamus*L.	Rhizome	Dry powder 3-5 gm
2.	*Allium sativum*L.	Bulb	Eaten raw
3.	*Allium wallichii*Kunth.	Bulb	Eaten raw
4.	*Aloe vera* (L.)Burm.f.	Aloe gel	Aloe leaf is peeled and sliced to extract gel which is taken orally
5.	*Ananascomosus*(l.) Merr.	Fruit	Ripe fruit is taken orally
6.	*Azadirachtaindica*A. Juss	Bark, Seed, Leaves	Dry powder 3-5 gm
7.	*Berberisaristata*L.	Stem	Bark decoction is used for drinking
8.	*Boerhaviadiffusa*L.nom.cons.	Whole Plant	Plant juice of whole plant is given to drink
9.	*Cedrusdeodara (Robx.)* G.Don	Heartwood	Decoction of heartwood is used for drinking
10.	*Cinnamomumtamala*Nees.	Leaf, bark	Bark decoction is used for drinking
11.	*Curcuma longa* L.	Rhizome	Dry powder 3-5 gm is taken with milk in the night
12.	*Dactylorhizahatagirea*(D.Don)Soo	Tuber	Dried tuber is taken with milk or water
13.	*Elaeocarpusgranitus*Roxb. ex G.Don	Bark, Fruit	Bark decoction is used for drinking / Fruit is worn as an ornament
14.	*Elettariacardamomum*(L.) Maton	Seed	Dry powder 3-5 gm is taken with water
15.	*Herpetospermumpedunculosum*(Ser.) Clark	Fruit	Dry powder 3-5 gm is taken with water
16.	*Hordeumvulgare*L.	Seed	Pudding is made and taken twice a day
17.	*Meliaazedarach*L.	Bark	Bark decoction is used for drinking
18.	*Mimosa pudica*L.	Stem	Plant juice of stem is given to drink
19.	*Momordicacharantia*Linn.	Fruit	Fruit juice is taken twice a day
20.	*Moringaolifeira*Lam	Bark, leaves	Decoction is used for drinking
21.	*Morusnigra*L.	Fruit	Fruit is taken
22.	*Murrayakoenigii*(L.) Sprengel	Leaves, seed	Plant juice of leaves is given to drink
23.	*Nardostachysjatamansi*(D.Don) DC.	Root	Dried tuber is taken with milk or water
24.	*Neopicrorhizascrophulariifo-lia*(Pennell) Hong	Root	Dry powder 3 gm is taken with water
25.	*Nerium oleander* L.	Root, root bark	Dry root powder 2 gm is taken with water
26.	*Nyctanthesarbortristis*L.	Bark	Decoction prepared from bark is used for drinking / Plant juice of leaves is given to drink
27.	*Ocimum sanctum* L.	Whole plant	Plant juice of leaves is given to drink
28.	*Phyllanthusembolica*L.	Fruit	Fruit is eaten raw
29.	*Rhododendron ferrugineum*L.	Bark, Leaves, Flower	Decoction prepared from bark is used for drinking
30.	*Rauvolfia serpentine* (L.)Benth. Ex Kurz	Root	Dry root powder 5 gm is taken with water
31.	*Rubiacordifolia*L	Whole plant	Decoction prepared from root/whole plant is used for drinking
32.	*Swertiachirayita*(Roxb, ex Fleming)	Whole plant	Plant juice of leaves/whole plant is given to drink

33.	*Tinosporacordifolia*miers	stem, root	Stem juice and juice of *embilicaofficinalis* mixed with curcuma longa powder is taken twice a day.
34.	*Tribulusterrestris*L.	Stem, Root	Decoction prepared from bark is used for drinking
35.	*Trigonellafoenumgracum*Linn.	Seed	Dry seed powder 5 gm is taken with water twice a day
36.	*Urticadioca*L.	Whole plant	Dry leaves powder 5 gm is taken with water twice a day
37.	*Valerianajatamansi*Jones	Root	Dry root powder 3 gm is taken with water twice a day Decoction prepared from root is used for drinking
38.	*Withaniasomnifera*(L.)Dunal	Root	Dry root powder 5 gm is taken with water twice a day

Figure 1: Bar chart showing the frequency of plant life form
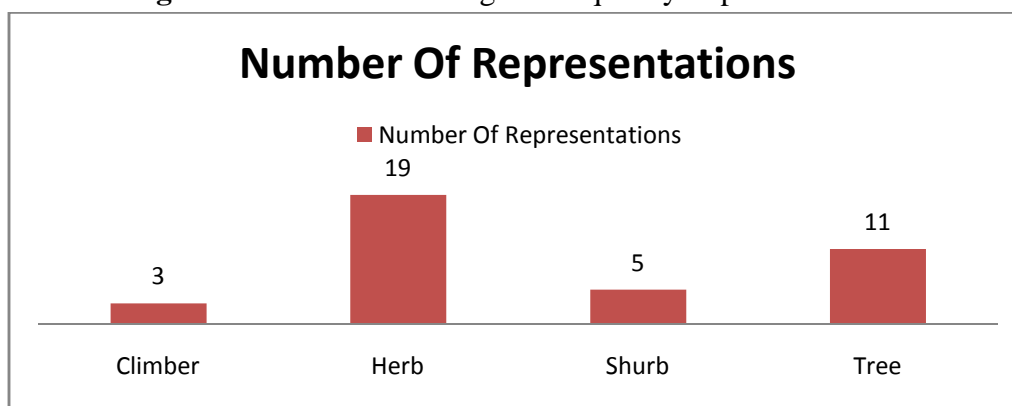
Figure 2: Pie chart showing the percentage occurrence of the plant parts
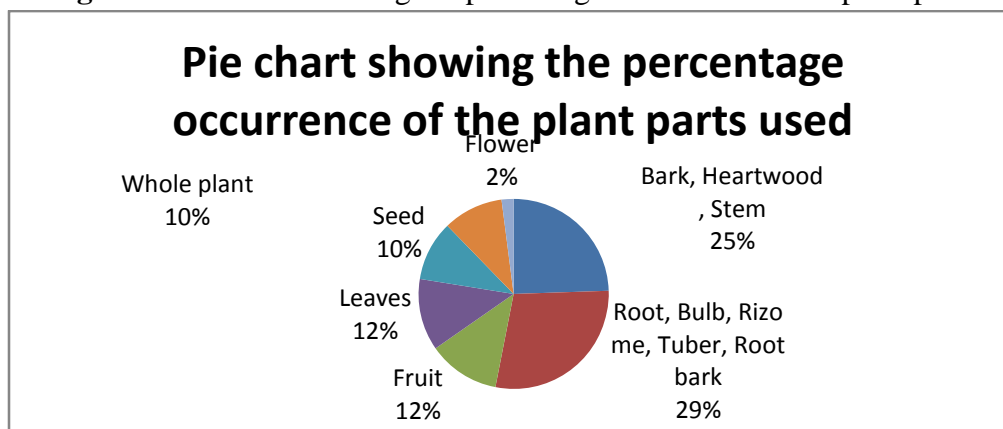
DISCUSSION

Currently, there is no data on medicinal plants used to treat Hypertension in Nepal. Therefore, these findings could be important in the management of hypertension and future study on traditional medicine in drug development. During the interview, what we personally felt was, generally traditional healer consider those plants which are bitter in taste is anti-hypertensive. Similarly, Local people view

herbal treatments as more effective and cheaper compared to the orthodox-medicine. They also consider herbal medicines don't have any side effects.

From this study we can find that ethno medicinal knowledge is concentrated among the senior members of the families (38 out of 48 respondents were more than 40 years of age), and in the study area it was mostly handled by *Dhamis, Jhakris* and local Herb Sellers. Information gathered from respondents reveled that majority of respondents acquired their ethno medicinal knowledge from their ancestors via verbal transfer. Such knowledge should be documented as early as possible because currently most people are opting to change their occupation and such knowledge are in verge of extension. Similarly study revealed that mostly illiterate or lesser educated people are prescribing traditional healing. Due to that the trust among those people who use medicinal plants as their primary health care is slowly diminishing. Formal education or training is a must for their sustainable development.

Major Challenge we faced during this study includes: Respondents not willing to give relevant information due to fear of losing their income,; some demanded money prior to interview while some people even castigated government for neglecting them and sending researchers to exploit their knowledge. Similarly some of them opt to share their knowledge in Television rather than to us to advertise their names and services.

The major drawbacks currently found in using these medicinal herbs are; there are no scientific systems of identifying, collecting and re-

generating 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 anti-hypertensive agents so better care must be taken now. However, many other investigations and research must be carried out to evaluate the mechanism of action pharmacologically of these medicinal plants.

CONCLUSION

The study affirmed that herbal medicines could have great potentials to cure and maintain Hypertension. The indigenous rural communities in Sankhuwasabha depend highly on traditional health care system. The study also revealed that there was high diversity of medicinal plants and traditional knowledge about the use, preparation and applications of these medicinal plants in Sankhuwasabha. However, the knowledge of herbal medicine has been found among elders and this may not enhance continuity in the use of these plants if such elders' are no more. The decline on the use of plants by the younger generation may gradually lead to the extinction of indigenous knowledge associated with medicinal plants. Awareness and program should also be organized by the government against deforestation, because some of the plants mentioned are almost in extinction and are no more available in residential areas. Government should provide a forum for growers, traders and manufacturers of herbal medicine and professional in the field of traditional and alternative thera-

pies to share knowledge, experience and ideas.The study of ethno botanical survey of plants as therapeutic agents is importance in addressing health problems. These ethno botanical data may provide a base to start the search for their potential as good antihypertensive drugs and provide clues for the development of new and better oral drugs for hypertension. More so, awareness regarding the conservation status of rare medicinal plants, domestication strategies as well as appropriate methods of exploitation is crucial for further studies to ensure a sustainable utilization and availability of these plants.

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