Research article

Folklore claims of medicinal plants against sprain from the Western Ghats region of Dakshina Kannada district, Karnataka state, India

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ABSTRACT

Introduction and Aim: Plants form the primary source of medicinesboth in traditional and modern methods of treatment. People residing at remote and rural regions still depend on traditional herbal medicine for their primary health care needs. This study aimed to document ethnomedicinal plants used in the treatment of sprain in the Western Ghats region of Dakshina Kannada district, Karnataka state, India.

Materials and Methods: An ethnobotanical study was carried out in Western Ghatsregion of Dakshina Kannada district, Karnataka during 2018-2021 to document the medicinal plants used by traditional practitioners to treat sprain. Data was collected using a semi structured questionnaire and open-ended interviews with herbal healers. Data was analyzed using simple statistical methods and few quantitative parameters.

Results: A total of 40 plant species of belonging to 30 families have been documented. Some significant recorded plant species are *Aloe vera*, *Litsea glutinosa*, *Cissus quadrangularis*, *Abrus pulchellus*, *Antidesma acidum*, *Holarrhena pubescens*, *Litsea wightiana* and *Ziziphus rugosa*. Younger generations are ignoring the uses and cultural importance given to such ethno- medicinal practices. This knowledge is based on oral tradition often passed on to the next generation.

Conclusion: Practitioners of this region do not have any written documents pertaining to their precious knowledge. Hence there is an urgent requirement to document and preserve the traditional knowledge inherited by tribes and ethnic communities before it is completely lost.

Keywords: Ethnomedicine; Western Ghats; Dakshina Kannada; sprain.

INTRODUCTION

Sprains are the most common musculo-skeletal injuries caused by stretching or tearing of ligaments within a joint. Sprains can occur in any of the joints, with most specific points being ankle, knee, and wrist. Acute musculoskeletal injuries and sprains account for nearly 75% of the ankle injuries. Ankle sprains are of high prevalence in children than in adults. Chronic sprains not only limit physical activity but could lead to articular degeneration of the joint and an increased risk of arthritis (1, 2). American Academy of Family Physician (AAFP) categorizes the ankle sprain into three grades based on the severity of the symptoms. Grade-1 sprain is a very mild type caused by the stretching of ligaments. Grade-2 sprain is characterized by a moderate injury which may cause discomfort due to the partial tear of one or more ligaments. Grade-3 sprains are accompanied with very severe injury which will cause a lot of discomfort and pain due to complete tear of one or more ligaments.The risk of prevalence is either due to falls, lifting heavy objects, exertion of unfamiliar sport, knocking a joint out of position and overstretching of the supporting muscles or ligaments.Grade-1 sprain does not require any therapy, where as grade- 2 and grade-3 sprains require proper clinical treatments for recovery. If neglected, it would cause more severe musculo-skeletal complications. Sometimes surgical repair must be made in order to rectify the torn muscle tissue and ligaments (3). Physicians usually prescribe dopamine and opioids such as fentanyl, morphine, and oxycodone to overcome the acute pain. However, these drugs have potential side effects and risk of addiction. Hence culturally accepted traditional medicine is the only alternative method for treatment for sprains (4).

Plants are the important source of various nutraceuticals which have direct or indirect impact in the treatment of various human ailments. India is one among 12 megadiversity countries of the world due to its richer biotic resources and accounts for about 8% of the global biodiversity with approximatetely 49,000 species of plants of which 4,900 are endemic (5). According to World Health Organization more than 80% of the people in developing countries still rely on ancient system of folk medicine even after the availability of modern medicine (6). The use of ethnomedicinal plants for primary health care systems is still popular in India because of easy availablity, inexpensive and their least or no side effects. It is estimated that tribes and indigenous communities of

India use>10,000 species of wild plants for various purposes, out of which nearly 8,000 species are used as medicine (7, 8). Documentation of ethnomedicinal plants used for the treatment of human diseases and disorders has been conducted in Western Ghats region of Karantaka. There are only few documentations of medicinal plants used by ethnic people and tribes in Dakshina Kannada district (9-12). Moreover, no work has been carried out on the use of medicinal plants against sprains. However, in the Western Ghats region of Dakshina Kannada district, rural and ethnic people have popular folk medicinal approaches for treating sprain. This study deals with the traditional knowledge of medicinal plants to treat sprain disorders in the Western Ghats region of Dakshina Kannada district.

MATERIALS AND METHODS

Study area

Dakshina Kannada district is boardered by seashore in the west and Western Ghats in the east. Western Ghats region of Dakshina Kannada district includes five revenue taluks namely Puttur, Sullia, Kadaba, Bantwal and Belthangady. It lies between 12^0 23' - 13^0 49' N latitudes and $74^0$37' - 75^0 41' E longitudes. The major rivers of study area are Payaswini, Phalguni, Kumaradhara andNethravathi.The district has a tropical monsoon climate. The rainfall varies from 3,774mm at coastal regions and 4,330 mm to 4,540 mm in the Western Ghats region. The major tribes, the Koragas and Malekudiyas inhabit theWestern Ghats Forest.Naika and Nalike tribes are found scattered throughout the district. Ethnic communities of the study area include Billava, Brahmin, Bunt, Kumbara, Vokkaliga, Devadiga and Vishwakarma. These tribes and ethnic communities have developed unique treatment aspects and rely on traditional medicine since ancient times for treating various ailments. The traditional knowledge of using plants for the primary health care systemhas been passed on from their ancestors on oral basis without any written documents.

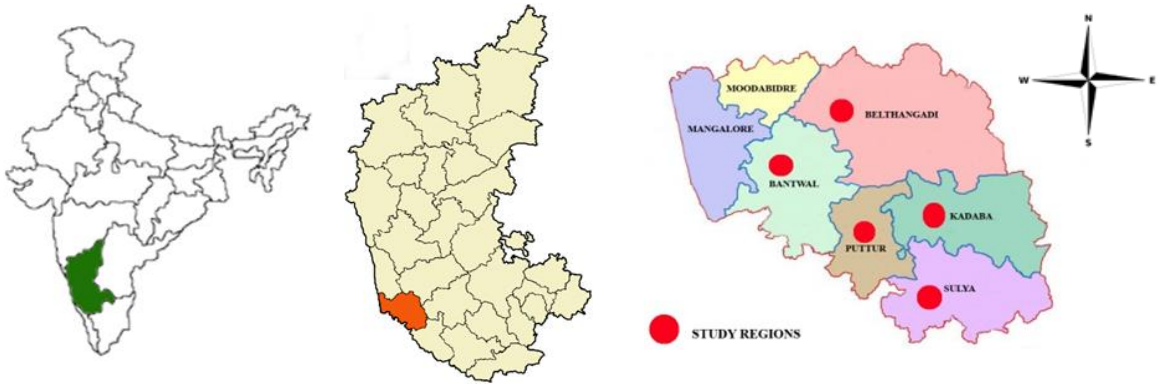


Fig. 1: Investigation sites; Dakshina Kannada district, Karnataka state, India

Ethno-botanical survey

Ethno-botanical information for treating sprains was documented from the local traditional healers in the study area between the years 2018 and 2021. The data was collected through semi-structured questionnaire andopen-ended discussions with traditional practitioners (13). Field trips were undertaken during different seasons to collect ethnobotanical data. The questionnaire contains details such as personal information of the traditional healer, name of the disease treated, source of knowledge, symptoms, local name of the plant, parts used, method and time of collection, method of preparation and mode of application of herbal drugs, dietary constraints, status of the plant, number of patients treated per week and experience in the field of treatment. Authentification of their information was made by repeated field visits and only consistent information on formulations is considered and recorded

Taxonomic identification of plant specimens

The plant species used to treat sprains were collected carefully during field visits. These medicinal plants were identified by consulting floras (14-16). The names of the plants have been updated using The Plant List (www.theplantlist.org) and the International Plant Name Index (www.ipni.org). Identified species were deposited in the herbarium of Department of Applied Botany, Mangalore University, Karnataka.

Data analysis

The ethnobotanical information collected from traditional healers was analyzed using simple statistical methods (17). Quantitative tools such as relative frequency of citation (RFC) and family importance value (FIV) were also used to compare the relative importance a species or a family assumes in the local medicinal system.

Relative Frequency of Citation (RFC)

Relative frequency of citation is an important quantitative index which is obtained by dividing the number of informants mentioning the uses of a particular species to the total number of informants participated in the study (18). Highest number of

citations for a particular plant species account for its importance in a community. It is calculated using the formula **RFC = FCs/N,** Where RFC = Relative frequency of citation; FCs = Number of informants who mentioned a particular species; N = Total number of informants.

RFC value usually ranges from 0 to 1. Therfore, RFC value is close to zero when only few informants mention a particular species and the upper limit 1 is obtained when a greater number of informants quote a particular species.

Family Importance Value (FIV)

Family importance value is used to estimate the local importance given to families of wild species. FIV is calculated by using the formula (19), **FIV = FC_{family}/N x 100,** where FIV= family importance value, FC_{family} = number of informants mentioned the family and N= total number of informants participated in this study.

RESULTS

Ethnobotanical information for the treatment of sprain was collected from 29 informants. Among them, 21 were male practitioners and 8 female practitioners. In the present study, a total of 40 species belonging to 30 families are used by the traditional healers in the study area for the treatment of sprain (Table:1).

Table 1: Ethnomedicinal plants used in the treatment of sprain

Sl No.	Botanical Name, Family Name and Voucher Number	Local Name	Parts Used	RFC
1	*Abrus pulchellus* Thwaites., Fabaceae, YGA 132	Usuluballi	Leaf, Root	0.10
2	*Achyranthes aspera* L., Amaranthaceae, YGA 055	Uttarani	Leaf, Stem	0.03
3	*Allophylus rheedei* (Wight) Radlk., Sapindaceae, YGA 060	Moorukabarinasoppu	Leaf	0.03
4	*Aloe vera* (L.) Burm.f., Xanthorrhoeaceae, YGA 013	Lolerasa	Leaf	0.28
5	*Antidesma acidum* Retz., Phyllanthaceae, YGA 104	Murginakodusoppu	Leaf	0.10
6	*Argyreia nervosa* (Burm.f.) Bojer., Convolvulaceae, YGA 134	AdambuSoppu	Leaf	0.03
7	*Aristolochia indica* L., Aristolochiaceae, YGA 068	Iswaraberu	Root	0.03
8	*Asystasia gangetica* (L.) T.Anderson., Acanthaceae, YGA 097	Maithal	Leaf, Stem	0.03
9	*Azadirachta indica* A.Juss., Meliaceae, YGA 043	Kahibevu	Leaf, Seed	0.07
10	*Barleria prionitis* L., Acanthaceae, YGA 121	Goranti	Leaf, Root	0.03
11	*Blepharis maderaspatansis* (L.) B.Heyne ex Roth.,Acanthaceae, YGA 021	Gadimaddu	Leaf	0.07
12	*Bryophyllum pinnatum* (Lam.) Oken., Crassulaceae, YGA160	KaaduBasale	Leaf	0.03
13	*Caesalpinia bonduc* (L.) Roxb., Fabaceae, YGA 064	Kalengikayee	Leaf, Seed	0.07
14	*Calophyllum inophyllum* L., Calophyllaceae, YGA 070	Ponnemara	Seed	0.03
15	*Cissus quadrangularis* L., Vitaceae, YGA 033	Sanduballi	Stem, Leaf	0.17
16	*Citrus reticulata* Blanco., Rutaceae, YGA 221	Narangi/ Kaipura	Fruit	0.03
17	*Croton persimilis* Mull.Arg., Euphorbiaceae, YGA 042	Somaraberu	Leaf	0.03
18	*Curcuma longa* L., Zingiberaceae, YGA 034	Arashina	Rhizome	0.03
19	*Eleusine coracana* (L.) Gaertn., Poaceae, YGA 143	Ragi	Seed	0.03
20	*Hemidesmus indicus* (L.)R.Br.exSchult., Apocyanaceae, YGA 018	Namadari/ Sukurma	Root	0.03
21	*Hibiscus rosa- sinensis* L., Malvaceae, YGA 082	Dasavala	Root	0.03
22	*Holarrhena pubescens* Wall. ex G.Don., Apocyanaceae, YGA 016	Kodenchi	Leaf, Bark	0.10
23	*Hopea ponga* (Dennst.) Mabb., Dipterocarpaceae, YGA 211	Kalmara	Leaf	0.03
24	*Ixora coccinea* L., Rubiaceae, YGA 028	Kepula	Root	0.03
25	*Jatropha curcas* L., Euphorbiaceae, YGA 102	Belialmuda	Seed	0.03
26	*Leucas aspera* (Willd.) Link., Lamiaceae, YGA 004	Thumbe	Leaf	0.03
27	*Litsea glutinosa* (Lour) C.B. Rob., Lauraceae, YGA 039	Erachikutti	Leaf	0.17
28	*Litsea wightiana* (Nees) Hook.f., Lauraceae, YGA 210	Ellukutti	Bark	0.10
29	*Madhuca neriifolia* (Moon) H.J.Lam., Sapotaceae, YGA 214	Nanil	Seed	0.03
30	*Myristica malabarica* Lam., Myristicaceae, YGA 061	Doddajaikai/ Ramapathre	Fruit	0.03
31	*Nyctanthes arbor-tristis* L., Oleaceae, YGA 054	Parijatha	Leaf	0.07
32	*Ocimum basilicum* L., Lamiaceae, YGA 125	Kamakasturi	Leaf	0.03
33	*Piper betle* L., Piperaceae, YGA 032	Bacchire	Leaf	0.07
34	*Piper nigrum* L., Piperaceae, YGA 029	Karimenasu	Seed	0.07
35	*Pongamia pinnata* (L.) Pierre., Fabaceae, YGA 107	Honge / Korungu Mara	Leaf	0.07
36	*Ricinus communis* L., Euphorbiaceae, YGA 020	Castor	Seed	0.03
37	*Russelia equisetiformis* Schltdl. & Cham., Plantaginaceae, YGA 120	Coral plant	Stem	0.03
38	*Scleropyrum pentandrum* (Dennst.) Mabb., Santalaceae, YGA 069	Nayikuli	Seed	0.03
39	*Trachyspermum ammi* (L.) Sprague., Apiaceae, YGA 165	Ajamoola/ Oma	Root	0.03
40	*Ziziphus rugosa* L., Rhamnaceae, YGA 156	KotteMullu	Leaf	0.10

Out of the documented ethnomedicinal plants, maximum remedies were obtained from tree species (14 species) followed by herbs (10 species), climbers and shrubs (8 species each) (Fig. 2). Majority of the species used in ethnomedicineare wild (31 species) and 9are cultivated (Fig. 3). In terms of number of species used, Fabaceae, Acanthaceae and Euphorbiaceae (3 species each) were found to be the dominant families followed by Apocyanaceae, Lamiaceae, Piperaceae and Lauraceae (2 species each) and other families with 1 species each (Table:1). Different parts were being used by practitioners in the preparation of herbal drugs (Fig.4).The most used plant parts in the treatment ofsprain are leaves (47.92%) followed by seeds (18.75%), root (14.58%), stem (8.33%), fruit and bark(4.17%ecah) andrhizome(2.08%).Mode of preparation and utilization of plant parts were divided into four categories (Fig. 5). Most prefered method of formulation was pastefollowed by oil, powder, and decoction. Among the formulations, 10 were monoherbal drugs and 13 polyherbal combinations. Regarding the mode of application, external applications are mostly preferred (86.96%) than internal application (13.04%) for the treatment of sprains in the study area.

The value of relative frequency of citation ranged from 0.03 to 0.28. Highest RFC value was recorded for *Aloe vera* (0.28), followed by *Litsea glutinosa* and *Cissus quadrangularis* (0.17 each), *Abrus pulchellus*, *Antidesma acidum*, *Holarrhena pubescens*, *Litsea wightiana* and *Ziziphus rugosa* (0.10 each). (Table: 1).

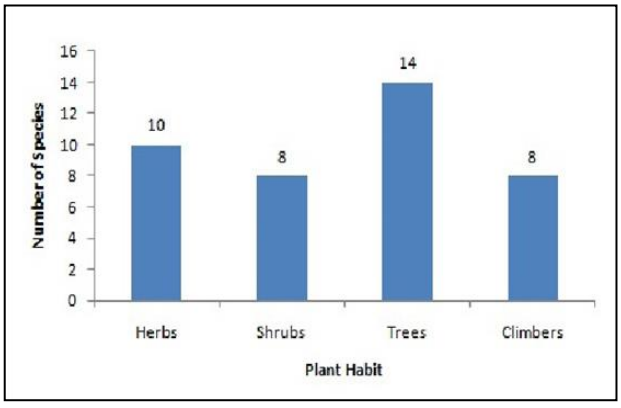
Similarly, the most common family of ethnomedicinal plant species to treat sprain was calculated based on FIV index (Table: 3). Highest FIV was shown by Lauraceae and Xanthorrhoeaceae (27.59% each) followed by Fabaceae (20.69%), Vitaceae (17.24%), Apocyanaceae, Acanthaceae and Piperaceae (13.79% each), Euphorbiaceae, Phyllanthaceae and Rhamnaceae (10.34% each).

Table 2: Formulations for treating sprain

Plant name and parts used	Mode of preparation	Application
Ziziphus rugosa (Leaf).	Paste is prepared.	External
Blepharis maderaspatansis (Leaf).	Ground in rice water and made into a paste.	External
Antidesma acidum (Leaf).	Crushed in rice water and made into a paste.	External
Cissus quadrangularis (Stem, leaf).	Crushed in rice water and made into a paste.	External
Litsea glutinosa (Leaf) + *Aloe vera* (Leaf).	Paste is prepared.	External
Argyreia nervosa (Leaf)	Paste is prepared.	External
Litsea wightiana (Bark)	Bark is dried, powdered, and taken with milk.	Oral
Leucas aspera (leaf) + *Aloe vera* (Leaf)	Paste is prepared.	External
Holarrhena pubescens (Leaf, Bark)	Dried, ground into powder and taken with milk.	Oral
Myristica malabarica (Fruit) + *Piper nigrum* (Seed).	Dried and crushed into powder and taken with honey.	Oral
Bryophyllum pinnatum (Leaf).	Crushed with termite nest soil and made into a paste.	External
Abrus pulchellus (Leaf, Root)	Crushed in coconut oil and hot paste is prepared.	External
Nyctanthes arbor-tristis (Leaf) +*Ocimum basilicum* (leaf).	Decoction is prepared.	External
Eleusine coracana (Seed)	Ground with palm jaggery in rice water and hot paste has been prepared.	External
Allophylus rheedei (Leaf) + *Aloe vera* (Leaf).	Paste is prepared.	External
Aloe vera (Leaf) +*Pongamia pinnata* (Leaf).	Paste is prepared.	External
Asystasia gangetica (Stem, Leaf) + *Piper nigrum* (Seed) + *Citrus reticulata* (Fruit).	Ground in rice water and hot paste is prepared.	External
Achyranthes aspera (Leaf, Stem) + *Curcuma longa* (Rhizome) +*Trachyspermum ammi* (Root).	Ground in rice washed water and made into a paste.	External
Caesalpinia boduc (Leaf, Seed) +*Azadirachta indica* (Seed, Leaf) + *Piper betel* (Leaf).	Paste is boiled in coconut oil.	External
Croton persimilis (Leaf) + *Hopea ponga* (Leaf).	Paste is prepared.	External
Ixora coccinea (Root) + *Hibiscus rosa-sinensis*(Root) + *Aristilochia indica*(Root) + *Hemidesmus indicus* (Root).	Paste is boiled in coconut oil.	External
Cissus quadrangularis (Stem) + *Litseaglutinosa* (Leaf) + *Russelia equisetiformis* (Stem) + *Barleria prionitis* (Leaf, Root).	Paste is boiled in coconut oil.	External
Calophyllum inophyllum (Seed) +*Jatropha curcas* (Seed) +*Madhuca neriifolia* (Seed)+ *Scleropyrum pentandrum* (Seed) + *Ricinus communis* (Seed).	Equal quantity of oil is mixed.	External

Table 3: Representation of Family Importance Value

Sl. No	Family	Family Importance Value (FIV)
1	Acanthaceae	13.79%
2	Euphorbiaceae	10.34%
3	Fabaceae	20.69%
4	Piperaceae	13.79%
5	Apocyanaceae	13.79%
6	Lamiaceae	6.89%
7	Lauraceae	27.59%
8	Apiaceae	3.45%
9	Amaranthaceae	3.45%
10	Aristolochiaceae	3.45%
11	Calophyllaceae	3.45%
12	Crassulaceae	3.45%
13	Convolvulaceae	3.45%
14	Dipterocarpaceae	3.45%
15	Malvaceae	3.45%
16	Meliaceae	6.89%
17	Myristicaceae	3.35%
18	Oleaceae	6.89%
19	Phyllanthaceae	10.34%
20	Plantaginaceae	3.45%
21	Poaceae	3.45%
22	Rhamnaceae	10.34%
23	Rubiaceae	3.45%
24	Rutaceae	3.45%
25	Santalaceae	3.45%
26	Sapindaceae	3.45%
27	Sapotaceae	3.45%
28	Vitaceae	17.24%
29	Xanthorrhoeaceae	27.59%
30	Zingiberaceae	3.45%



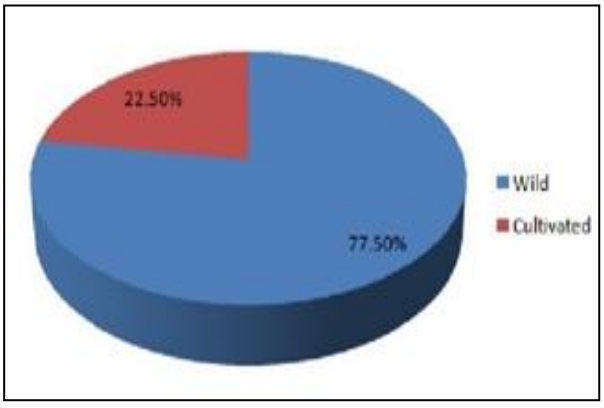
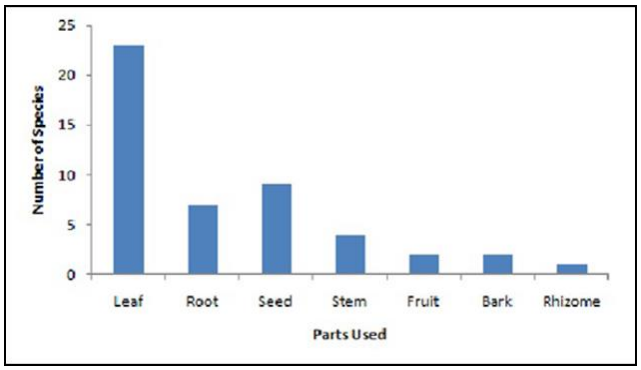


Fig. 2: Habit of ethnomedicinal plants**Fig. 3:** Habitats of ethnomedicinal plants



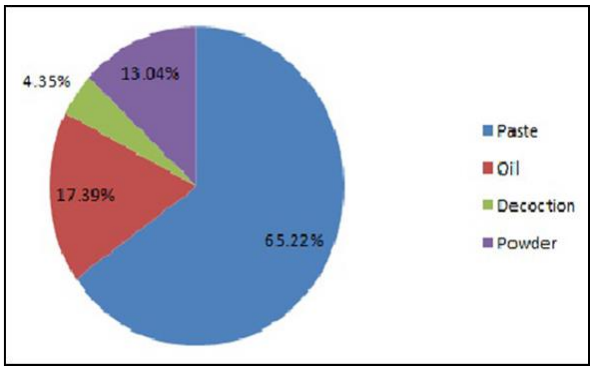


Fig. 4: Parts used versus number of species**Fig. 5:** Mode of utilization of herbal drugs

DISCUSSION

The traditional practitioners of Western Ghats region of Dakshina Kannada had a good knowledge of ethnomedicinal plants to treat various human ailments. Practitioners inherited their knowledge as a family heirloom.The maximum use of tree species in the preparation of ethnomedicine is in agreement with earlier surveys (20, 21).From this survey, it is evident that leaves are the principal organs used in the preparation of formulations.Leaves are the primary photosynthetic organs and attributed to their high medicinal value.Use of leaves predominantly in traditional medicine, has ensured the sustainable harvesting of medicinal plants (4, 22). Practitioners usually prefer fresh plant parts for the preparation of medicine. Occasionaly, few parts are collected, shade dried and preserved for future use. Traditional healers use different ingradients such as jaggery, cow's milk, honey, rice water, rice washed water, coconut oil, hot water,and soil in the preparation of herbal formulations. These ingradiients either enhance the therapeutic value of the formulation or serve as the medium which makes the process simpler (23, 24). In this study, it is observed that among 23 formulations, 10 are monoherbal preparations suggesting that even single plant species contain bioactive principle required for the treatment of sprains.

High RFC value indicates that a particular plant species was cited by maximum number of informants. It is worth to investigate the bioactive compounds from plant species with high RFC values.Present FIV index of plant families were compared with FIV index of plants used for few other disorders which revealed that local importance given to families of wild species depends on the extent of sharing knowledge between the informants (25, 26).Among the 40 documented plants, *Litsea wightiana* and *Hopea ponga* are endemic to Western Ghats. Also, *Hopea ponga* is in the endangered category according to IUCN 2000 (27).

CONCLUSION

Ethnomedicine is an integral part of human life and culture. There is rapid decline in the number of local medicinal plant species particularly in interior areas of Dakshina Kannada in the Western Ghats region. Anthropogenic pressures and changes in traditional land use practices have altered the native biodiversity. Number of traditional healers is also declining due to availability of modern medical facilities in remote areas. Even younger generations are least interested to preserve and practice of the valuable family centeredtradional knowledge. Hence, this study has tried to document the medicinal plants used against sprain by local healersin the study region. Further research and pharmacological validation of recorded plants need to be carried out for novel drug discovery.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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