



RESEARCH ARTICLE

Ethnobotanical exploration of medicinal plants for the treatment of migraine in Dakshina Kannada district of Western Ghats, Karnataka, India

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Abstract

Migraine is a recurrent neurological disorder of humans affecting approximately 15% of the population globally. It frequently appears in childhood, particularly around puberty and affects women more than men. Traditional medicine has a key role in primary health care system of people residing in remote and rural regions. This study has been carried out in Western Ghats of Dakshina Kannada district, Karnataka state, India during 2018 - 2021 to document ethno-medicinal plants used by traditional practitioners to treat migraine. Most people prefer herbal folk therapies against this chronic disorder. Ethnobotanical study was carried out by repeated field visits. Information pertaining to the migraine was gathered by open-ended discussions with local traditional healers through a semi-structured questionnaire. All together 67 key informants shared their unique method of treatment against migraine. A total of 53 plant species belonging to 29 families are being used by local folk practitioners. Data was analyzed by quantitative tools like Relative frequency of citation (RFC) and Family importance value (FIV) to compare the importance of reported plants. Leaves are the mostly used plant parts in the preparation of herbal formulation. Internal mode of application was more prevalent to treat migraine. Documentation of traditional knowledge of using plants in primary health care systems will be necessary in order to face new challenges by the modern medical world.

Keywords

Ethnobotany, Traditional medicine, Western Ghats, Dakshina Kannada, Migraine.

Introduction

Migraine is one of the most common, multifactorial, recurrent, disabling neurological disorders of humans. Chronic migraine imposes a substantial economic burden on community. It is more common in women than men. The risk of incidence is highest in females during adolescent period and there is gradual decrease in rate of incidence on attainment of adulthood (1-3). The exact aetiology of migraine is still unknown, but many triggering factors that increase the severity of pain have been identified. Genetic, environmental factors and life style are the probable causes for migraine disorder. World Health Organization estimated that mental and neurological disorders collectively account for 30.8%, of which migraine alone accounts for 1.4% and is in the top 20 causes of global disability. Migraine affects a large proportion of the non-fatal disease related burden globally (4, 5). International Headache Society (IHS) has recognized two types of migraine as migraine without aura and migraine with aura. Among these, migraines with-

out auras are most common and often associated with intense pain on one or both sides of head, nausea, dizziness, vomiting, disturbances of bowel function and sensitivity to light and sound. Migraine without aura lasts for 4-72 hrs. However only 20% of the migraine sufferers experience aura, before headache starts and usually lasts less than 60 minutes (2, 6). The frequency, duration and disability of attacks were much higher in women. The probable reason for this would be that they consult specialists frequently and also take more prescription drugs than men. Collecting detailed information on history of migraine is vitally important in the diagnosis (7). Allopathic system usually prescribes chemical drugs, antidepressants and antiepileptic drugs to overcome migraine. However, these drugs cause severe side effects which in turn create many psychological problems. Hence, traditional medicine is only the alternate source of treatment for this neurological disorder (8).

Western Ghats of India is a great repository of plant wealth and one among the 35 biodiversity hot spots of the world which harbours more than 4500 plant species of medicinal importance. Western Ghats region of Dakshina Kannada have a greater ethnic diversity. The tribes and ethnic people of this region have inculcated unique treatment strategies against various ailments. They have gained traditional knowledge from their ancestors as a family heirloom (9, 10). Ethno-botanical surveys have been conducted in different regions of Karnataka. Various studies have documented the ethnobotanical information on medicinal plants in remote areas of Dakshina Kannada, Kodagu, Mysore, Shimogga, Udupi and Uttara Kannada districts in the last two decades (11-19). However, very few plant species were reported against migraine in this region. In the past few years, there has been an exponential growth in the field of traditional medicine since herbal drugs are gaining more popularity because of their remarkable efficacy and natural origin. The widespread use of traditional medicine could be attributed to their therapeutic value, economic viability and cultural acceptability against various ailments (20). So far, there has been no specific documentation of ethnobotanical information against migraine in Dakshina Kannada district. This study is aimed to record the indigenous traditional knowledge of using medicinal plants to treat migraine.

Materials and Methods

Study area

Dakshina Kannada is the southern district of Karnataka state with an area of 4866 Sq.K.M. This district is bound by sea in the west and Western Ghats in the east. It lies between 12° 23' - 13° 49' N latitude and 74° 37' - 75° 41' E longitude. Western Ghats region of Dakshina Kannada include Puttur, Sullia, Kadaba, Bantwal and Belthangady taluks. Present surveys have been conducted in Western Ghats region of Dakshina Kannada (Fig. 1). Annual average rainfall varies from 3500 mm to 4550 mm. The main tribes of Dakshina Kannada are Koraga, Malekudiya, Nalike and Naika. Among the tribes, Koraga and Malekudiyas are

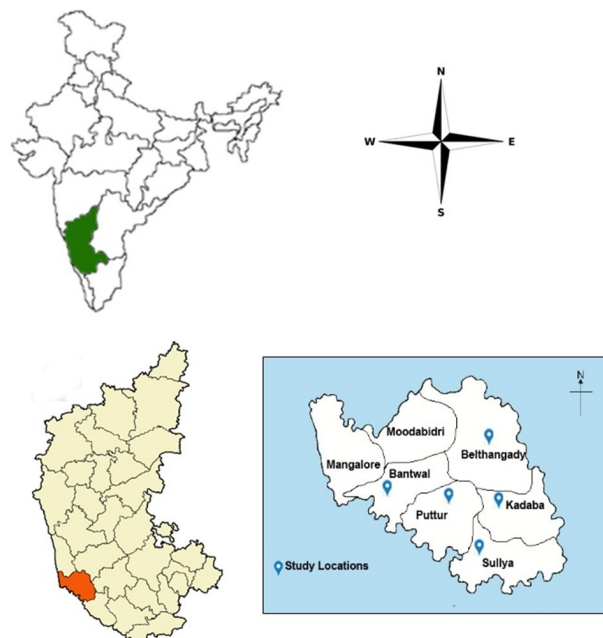


Fig.1. Investigation sites; Dakshina Kannada district, Karnataka state, India

found in Western Ghats forest. Ethnic communities such as Billava, Brahmin, Bunt, Devadiga, Kumbara, Vokkaliga and Vishwakarma are found throughout the district. This ethnomedical practice is predominantly based on oral tradition.

Ethno-botanical survey

Ethno-botanical information was documented from the traditional healers in Western Ghats region of Dakshina Kannada between 2018 and 2021 during different seasons by regular and repeated field trips. The aim and objective of the study was explained to the healers to convince them that this documentation is for academic purpose. The data was collected through semi-structured questionnaire (21) and open ended discussions with traditional practitioners (22). The questionnaire contains various information such as personal details of the traditional healer, source of knowledge, symptoms, vernacular name of the plant, plant parts used, method and time of plant collection, method of preparation and administration of herbal drugs, dietary restrictions, status of the plant, number of patients treated per week and experience in the field of treatment. The questionnaire also contained declaration part where practitioners declare their participation in the study and their consent to share the knowledge for academic purpose. Authentication of their information was made by regular and repeated field visits and only consistent formulation was considered and recorded.

Taxonomic identification of plant specimens

Plant specimens collected during field visits were identified consulting relevant floras (23-25). The names of the plants have been updated using recent literature sources (26, 27). After authentication, the voucher specimens were deposited in the herbarium of the Department of Applied Botany, Mangalore University, Karnataka.

Data analysis

The data was analyzed systematically in the MS excel

sheet. The information such as botanical name, family name, voucher specimen number, local name, part used in the preparation of herbal formulation were attributed to each species (20). Quantitative approaches such as relative frequency of citation (RFC) and family importance value (FIV) were also used to compare local importance given to a species or to a family.

Relative Frequency of Citation (RFC)

Relative frequency of citation is obtained by dividing the number of informants mentioning the use of a particular species to the total number of informants participated in the study. Highest number of citations for a particular plant species accounts for its popularity in a community. It is calculated using the following formula (28),

$$RFC = FCs/N$$

Where, RFC = Relative frequency of citation, FCs = Number of informants who mentioned a particular species and N = Total number of informants.

RFC value usually ranges from 0 to 1. Therefore, RFC value is close to zero when only few informants mention a particular species and tends towards upper limit (one) is obtained when more number of informants quote a particular species.

Family Importance Value (FIV)

Family importance value is used to identify the importance given to plant families. It is calculated by the following formula (29),

$$FIV = FC_{family}/N \times 100$$

Where FIV= family importance value, FC_{family} = Number of informants mentioning the family and N= total number of Informants participated in the study.

Results and Discussion

Demographic details of Informants

In the present study, 67 local traditional practitioners participated and shared useful ethnomedicinal information to treat migraine (Table 1). Among the informants, 19 were females and 48 males. Out of 67 informants, 64 healers inherited the traditional knowledge as a family heirloom and other three practitioners acquired it through internship. Majority of traditional healers are Nati Vaidhyas and agriculturists by profession while few were agricultural labourers. Most of the practitioners do not have formal school education. Younger generation with higher academic qualification hardly have any knowledge on medicinal plants due to their lack of interest. Among the practitioners, the age groups of 61-70 were well represented (38.80%) followed by 51-60 years (23.88%) and only few informants were between 41-50 age groups (16.42%). However, a significant number of healers (20.90%) were aged above 71years. This data is a clear indication that older people are still relying on the valuable traditional knowledge while younger generation moving away due to expansion of modern medical facilities to the remote areas and their migration to the cities in search of livelihood.

Table1. Demographic data of traditional practitioners

S. No	Variable	Categories	No. Of Persons	Percentage
1	Gender	Male	48	71.64%
		Female	19	28.36%
	Age group	Below 40 Years	Nil	0%
		41-50 Years	11	16.42%
2	Age group	51-60 Years	16	23.88%
		61-70 Years	26	38.80%
	Education	Above 71 Years	14	20.90%
		No Formal education	15	22.39%
3	Education	Primary Education	37	55.22%
		Secondary education	8	11.94%
	Profession	Higher Secondary Education	6	8.96%
		Graduation	1	1.49%
4	Profession	Natee Vaidyas	47	70.15%
		Agriculturist	9	13.43%
	Source of Knowledge	Agricultural Labourers	11	16.42%
5	Source of Knowledge	Family Inheritance	62	92.54%
		Trained	5	7.46%

Similar conclusions have been drawn on demographic characteristics of informants in earlier reports of ethnobotanical studies (30-32).

Diversity of medicinal plants

A total of 53 medicinal plants belonging to 29 families are being used by traditional healers to treat migraine in the Western Ghats region of Dakshina Kannada (Supplementary Table 1). The most represented family was Fabaceae, Apocyanaceae and Lamiaceae (5 species each) followed by Phyllanthaceae, Acanthaceae and Apiaceae (3 species each), Euphorbiaceae, Rutaceae, Amariyllidaceae, Solanaceae, Asteraceae and Menispermaceae (2 species each) and other families represented by one species each. Similar earlier reports have proven the domination of Fabaceae, Apocyanaceae, Lamiaceae, Acanthaceae, Solanaceae and Phyllanthaceae to treat various human ailments in different regions (20, 28, 46). The popularity and high preference of the members of the families such as Fabaceae, Apocyanaceae and Lamiaceae in Indian traditional medicine may be attributed to their abundance, availability and adaptability to different environments (47). Additionally, antioxidant activity, analgesic property, antidepressant activity, neuroprotective and anxiolytic effect of these plant species are also attributed to their medicinal value and highest representation in treating various ailments.

Habit and habitat of medicinal plants

Herbs are the primary source of medicine to treat migraine (35.85%) followed by trees (28.30%), shrubs (18.87%) and climbers (16.98%) (Fig. 2). Wider utilization of herbs and tree species in traditional medicine was observed in the previous ethnobotanical studies of different regions of the

world (16, 48, 49). Among the documented species, 38 were wild and 15 species are cultivated (Fig. 3). Dependence on wild species for primary health care system in traditional and modern medicine clearly indicates the need for proper conservation strategies and sustainable utilization of the plant wealth. Otherwise these species in the wild would become threatened and endangered in the near future. Modern developmental activities in the Western Ghats region are a major threat to biodiversity.

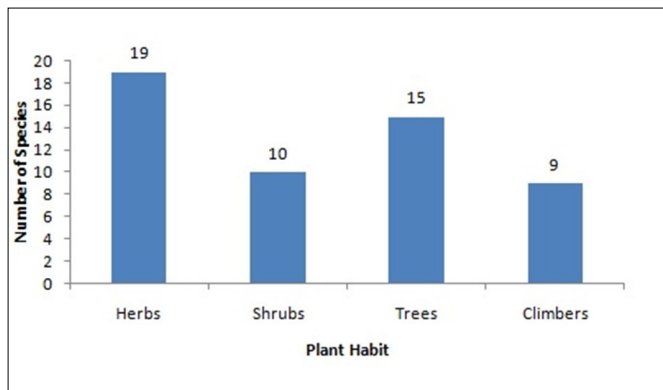


Fig.2. Habits of ethnomedicinal plants.

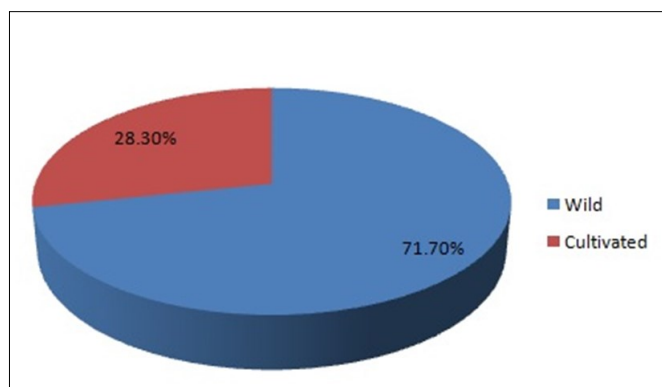


Fig.3. Habitats of ethnomedicinal plants.

Plant parts used and method of preparation of herbal drugs

Different plant parts are used in the preparation of herbal drugs by local healers to treat migraine. Traditional practitioners mostly use leaves (41.67%) followed by roots (13.33%), seeds (10%), bark (8.33%), stem and whole plant (5% each), shoot tip, fruits and bulbs (3.33% each), heart wood, flower, latex and rhizome (1.67% each) (Fig. 4).

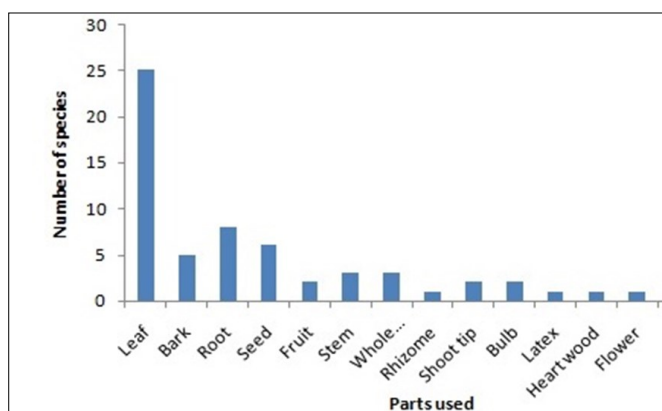


Fig.4. Parts used versus number of species.

Healers mostly use leaves for drug preparation because they are active sites of photosynthesis where more bioac-

tive molecules accumulate and can be easily collected than underground parts, fruits and flowers (15, 20, 50). Most of the plant parts are collected afresh and very rarely preserved parts are being used, since fresh parts form more effective drug (17).

Herbal formulations are divided into 6 categories like juice, paste, oil, decoction, latex and powder (Fig. 5).

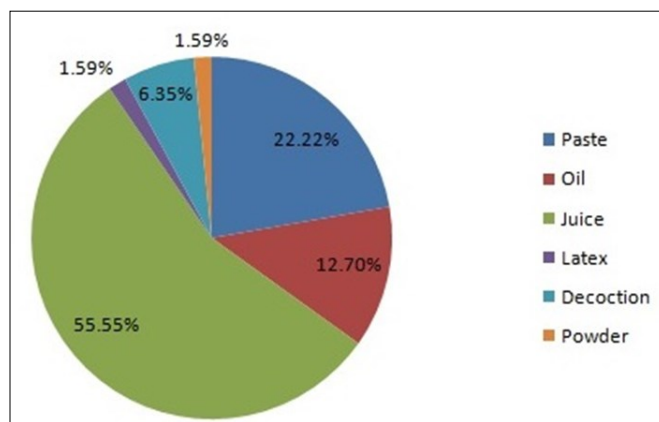


Fig.5. Types of formulation.

Healers used 63 different formulations to treat migraine very effectively (Supplementary Table 2). Out of which 28 preparations were monoherbal and 35 are polyherbal drugs. Earlier reports on neurological studies showed that decoction, paste and juice were the commonly used formulations (51, 52). The different ingredients such as rice washed water, oil, ghee, cow's milk and red ants were used to prepare drug formulations. These ingredients serve as a medium and also enhance the medicinal value of the drug (53, 54).

Mode of application and dosage

Method, dosage and duration of treatment for migraine depends on factors such as patient's age, physical condition and the severity of symptoms. These factors are generally considered for the treatment of all kind of disorders in traditional medicine. Internal uses were dominant (61.90%) over external uses (38.10%) (Fig. 6). Nasal appli-

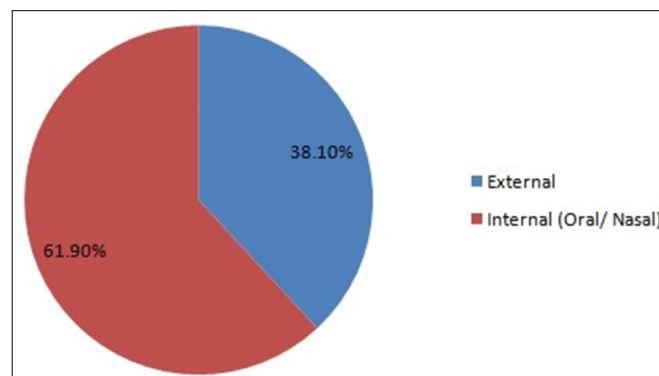


Fig.6. Mode of application of herbal drugs.

cation of 2-3 drops of juice was the most common method in internal mode. Similar mode of usage was reported in the earlier studies also (42, 55). External mode of treatment mainly involves application of paste or oil on forehead for a prescribed duration of time. The healers usually prefer early morning for the treatment and suggest few dietary restrictions and yoga practice.

Quantitative analysis

In order to calculate the relative importance of recorded ethnomedicinal plants, relative frequency of citation (RFC) were calculated based on the number of informants who cited the species to the total number of informants. In the present study, RFC value ranged from 0.01 to 0.28 (Supplementary Table 1). Highest RFC value was recorded for *Naravelia zeylanica* (0.28), followed by *Leucas aspera* (0.25), *Allium sativum* (0.22), *Allium cepa* (0.18), *Cuminum cyminum* (0.15) and *Brassica nigra* (0.09). High RFC value indicates that a particular plant species was cited by maximum number of informants. Those plants having high RFC can be further assessed for phytochemical and pharmacological studies to isolate active metabolites for drug development (56).

Similarly the most common family of ethnomedicinal plant species to treat migraine was calculated based on FIV index. Highest FIV was shown by Amaryllidaceae (34.33%) followed by Lamiaceae (29.85%), Ranunculaceae (28.36%), Apiaceae (19.40%), Apocyanaceae (13.43%), Fabaceae and Brassicaceae (8.95% each), Acanthaceae (7.46%), Phyllanthaceae, Euphorbiaceae, Asteraceae, Moringaceae and Menispermaceae (5.97% each), Rutaceae, Piperaceae and Solanaceae (4.48% each), Xanthorrhoeaceae (2.98%) and other reported families have shown least FIV (1.49% each) (Supplementary Table 1). Present FIV index of plant families when compared with FIV index of few other surveys revealed that local importance given to families of wild species depends on type of disease treated, availability of plant species and familiarity with native medicine (28, 29, 57).

Conclusion

Migraine is a common and undertreated neurological disorder. The present investigation concluded that the tribal and local people in the study area have their unique way of utilizing medicinal plants to treat migraine. All the 63 formulations suggested by the traditional healers are based on their practical experiences. Most of the formulations documented in the present study are new reports. The knowledge is local but it is rich, informative and effective. This knowledge should be preserved and widely practiced. Younger generation are least interested in the system since modern medical facilities are easier and readily available. Modern development activities, agricultural expansion and unscientific collection have led to habitat loss and are the primary causes of reduction of the biodiversity of medicinal plants. Appropriate awareness programmes, conservation planning and sustainable harvesting practices are very essential to preserve the medicinal biodiversity of the Western Ghats region. Additionally, some of the pharmacological effects of these plant species have been investigated pertaining to neurological disorders. The data recorded can possibly be used as a potential source for developing novel drugs for the treatment of migraine.

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Authors contributions

YA and KG designed the work. YA carried out field survey, drafted the manuscript and prepared herbarium. YA and KG identified the plant specimens. KG supervised entire study and critically evaluated the manuscript. The authors, YA and KG have read the final manuscript and approved its submission.

Compliance with ethical standards

Conflict of interest: The authors declare no conflicts of interest.

Ethical issues: None.

Supplementary data

Table 1. Ethnomedicinal plants used against migraine

Table 2. Formulations for treating migraine

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