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Ethnobotanical survey of medicinal plants used by the "Nalike" community in the Bantwala taluk of Dakshina Kannada district, Karnataka, India

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Abstract

The "Nalike" community, also known as Panar, is one of the tribal communities in the Bantwala taluk in Karnataka's Dakshina Kannada district. In addition to the practise of ritual dance, the majority of the families in this community embrace traditional medication as a source of income. For the ethnobotanical survey, a total of 25 informants were chosen and documented 160 medicinal plant species from 65 families including their botanical name, trivial name, family name, plant parts used and medicinal uses. The most frequent families are Leguminosae (17 species), Rubiaceae (9 species), Apocynaceae (7 species), Myrtaceae (7 species) and Lamiaceae (7 species). To cure various disorders, different portions of medicinal plants are employed in the manufacture of various types of traditional medicine such as decoction, infusion, paste or powder. A total of 39 diseases were identified and classified into nine disease categories. All informants treat paralysis with *Syzygium aromaticum*, *Cinnamomum verum* and *Glycyrrhiza glabra*, as well as other medicinal plants in various combinations, in the category of neurological illnesses.

Keywords

Nalike community, ethnobotanical survey, informants, traditional medicine

Introduction

Ethnobotany is the study of aboriginal communities' interaction with the vegetation. The Indian subcontinent, with its rich biodiversity and diversified ethnic heritage, is a magnificent emporium and treasure trove of ethno botanical wealth. Each tribal/ethnic community has its own system of traditional medicine, and they use natural resources in their surroundings for a variety of medical purposes. Traditional herbal medicine is still used by a big portion of India's rural population living distant from urban areas for their main health care requirements. This is due to the fact that medicinal herbs are readily available natural goods that are also inexpensive. Ethnic medications have frequently provided new drugs or active substances for a variety of serious illnesses. As a result, the World Health Organization has acknowledged the importance of the job (1).

Ethnomedicine is a sort of traditional medicine utilised by India's tribal and aboriginal populations to treat illnesses (1). In Indian culture and folklore, herbal healing has a long history. In southern peninsular India and the Western Ghats ecosystem, there are roughly 6000 kinds of higher plants,

with an estimated 2000 indigenous species. 2500 species from over 1000 genera and 250 families have been used in traditional medical systems (2-4).

Traditional healers, Pundits and Ayurveda practitioners practise ethnomedicine widely in the Dakshina Kannada district. In Coastal Karnataka, 342 ethnomedicinal plant species have been described, as well as a list of 50 important ethnomedicinal plants that have been used to treat five or more ailments. A total of 192 Ayurvedic remedies and 84 proprietary patent drugs are utilised to treat asthma, bronchitis, menstruation and liver illnesses in this territory (5). Herbal medicinal knowledge has been passed down orally from generation to generation, with the result that it has deteriorated (6, 7).

The bulk of the prominent families in the Nalike community make their living through ethnomedicine and ritual dances such as "Buta kola" and "Daivanema." This was handed down from their forefathers to them. Traditional folk healers can treat a wide range of illnesses. Patients travel from all around the state to get treatment. Only a few districts in Karnataka, such as Uttara Kannada, Mysore and Shimoga, have ethnobotanical knowledge reports. In the Dakshina Kannada district, herbal folk medicine literature was scarce. As a result, ethnobotanical knowledge was documented through a study of the Nalike population in the Dakshina Kannada area of Karnataka. Twenty-five traditional healers from the Nalike community documented 160 ethnomedicinal herbs for this study.

Materials and Methods

Study Area

Bantwala is a taluk in the Dakshina Kannada district of Karnataka. The name Bantwala is made up of two words: Banta Wala, which means "where Bunts live" in Tulu, the district's original dialect. It is located on the banks of the Nethravati River (5). Kerala state is bordered on the south by taluk, on the east by Belthangady and Puttur taluk, and on the west by Mangalore city. It is located between the latitudes of 12.8936°N and 74.9947°E. Its total land area is around 720 km^2. A large number of Billava, Vishwakarma, Brahmin, Bunts, Bhandary, Ganigas, Kulals and Gouda Saraswat Brahmins, Muslims, Christians and a few Jains live in Bantwala taluk (Fig. 1).

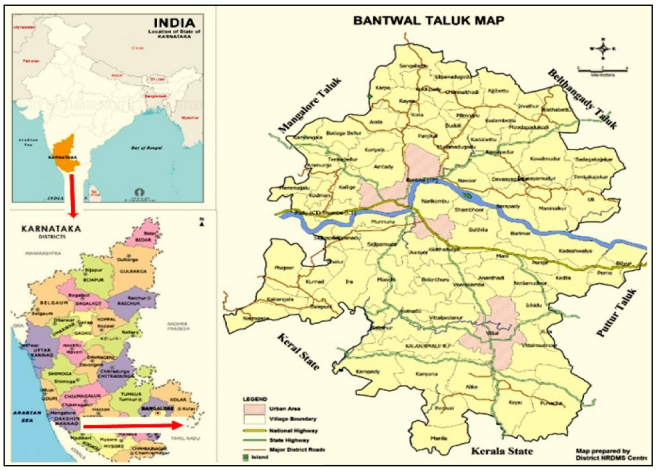

Fig. 1. Map of the study area.

Methodology

Primary data is acquired from key informants such as patients who visited the healers and interviews with senior citizens in the hamlet. The informants (Healer) submitted data through semi-structured, open-ended interviews and a questionnaire (8). The information is acquired in the native Kannada language and then translated into English. The plants they use to treat diseases, their vernacular names, the parts of the plants they use, the form in which they are used, the causes of diet, the other ingredients added during drug formulations, the symptoms of the ailments they treat, the average number of patients, and finally their experience in the field of treatment were all noted and recorded.

During the survey, the guided field walk technique (8, 9) was utilised, depending on the convenience of the practitioner. A trip into the forest with the healers provided confirmation of the medicinal plants they use in their therapies as well as the opportunity to collect particular data. After each informant was interviewed more than twice, only those formulations that were consistent were included. Standard floras such as Flora of Karnataka (10, 11), Flora of Udupi (12) and Flora of South Canara (12) are used to verify plants collected during the guided field trip with herbal healers (13). According to the plant APG list (14), the most recent names of the plants (APG method of categorization) have been supplied. All medicinal plants used to cure various ailments were photographed in the field and voucher specimens were made and housed at the Herbarium of Mangalore University's Department of Applied Botany.

Community study

In the Bantwal taluk, the Nalike or Panar are a scheduled caste. Pana is a Tulu word that means "song." "Buta Kola" or "Daivanema," a ritual dance performed by the Nalike people, is well-known. Ritual dance is an important part of Daivaradhane/Bootharadhane (rituals) in Dakshina Kannada, and the community still has the old privilege of doing it. The dance is highly stylized and performed in honour of local deities, with ritual professionals from Nalike communities channelling local spirits or deities (butas, daivas) by singing folk songs (Pad-dana) accompanied by dancing, which are widely performed and prayed for by ordinary people (15).

Quantitative Data Analysis

It is important to translate qualitative data into quantitative data to undertake hypothesis testing, statistical validation and comparative analysis (16). Quantitative data makes it easier to find prospective pharmacologically significant plants (17). To analyse the ethnobotanical data, both qualitative and quantitative ethnobotanical indices were employed. Qualitative data such as botanical name, family, local name, portion utilised, habit and status are examples of qualitative data. Each species is given quantitative indexes like Relative Frequency Citation (RFC) and Use Value (UV) (Supplementary Table 1). Other quantitative indices such as the Family Use Value-FUV, the Percentage of Habit Used, the Consensus Value for Plant Part-CPP,

the Fidelity Level-FL, the Informants Consensus Factor-ICF and the % of Plant Species Used are tabulated separately (18, 19).

Use Categories

A systematic strategy was used to classify the reported medicinal plant applications into several illness categories (20). Each time a plant was referred to as 'used,' it was regarded as a single report.

Use Report (UR)

It is the total number of uses made of a species by all informants within each use category. If a single informant reported using a plant to treat multiple diseases within the same category, it was deemed a single use-report (21).

Relative Frequency Citation (RFC)

This measure was developed in order to assess the relative value of a specific species (22). It is calculated using the formula.

$$RFC = FCs / N$$

Where, RFC = Relative Frequency of Citation, FCs = Number of informants who mentioned the use of species, N = Total number of informants. RFC value varies from 0 (when nobody refers to a plant as a useful one), to 1 (when all the informants mentioning it as useful).

Use Value (UV)

The Use Value of a plant is determined by the number of reported uses (23). The purpose is to determine the relative value of species within a community. The use value of a species indicates how essential it is to a community. It is determined using the following formula:

$$UVs = \Sigma Us / N$$

Where, UVs = Use Value for the species, Σ Us = Sum of the uses mentioned for a species, N = Total number of informants. When there are several reports of a plant's use, the value is high, signalling that the plant is significant, and it approaches zero (0) when there are few reports of its use. However, the usage value does not discriminate between plants that are employed for a single or several uses (24).

Fidelity Level (FL)

Fidelity level was calculated to highlight the importance of each plant for each ailment and is calculated as

$$FL= Np / N \times 100$$

Where Np = number of informants who cited the species for a particular disease. N = total number of informants that cited the species to treat any given disease. The FL values range $0\% < FL \leq 100\%$ (25). A plant's high FL value indicates its high frequency of use or efficacy in treating a certain condition. On the other hand, low FL values may indicate that the species is not used frequently or is less successful in treating the specific condition (26).

Informant Consensus Factor (ICF)

The informant consensus method (27, 28) was used to determine the degree of homogeneity in the information provided by the informants. The informant consensus factor (ICF) product ranges from 0 to 1.0; a high number (close to 1.0) implies that a large proportion of informants employ fewer plant species, whereas a low value (0.1) reflects informants disagreement on the species used for the particular ailment category. ICF is calculated by using the formula-

$$ICF= Nur – Nt / Nur - 1$$

Where NUR denotes the total number of use reports for a given category of ailment and NT denotes the total number of plant species for that category of ailment (29).

Family Use Value (FUVs)

This index calculates the use value of a family and the formula is as follows:

$$FUVs = \Sigma UVs / NS$$

Where, FUVs = Family Use Value, Σ UVs = Sum of the Use Values of all the species quoted from a family, NS = Total number of species quoted from the family (30).

Consensus value for Plant Part (CPP)

It is a measure that indicates the degree of agreement amongst informants regarding the plant part used (31). The following is the formula:

$$CPP = Px / Pt$$

Where Px = number of times a given plant part was cited and Pt = total number of citation of all parts (32).

Results

Use Value

The Use Value (UV) of a plant is used to assess its relevance based on the diversity of applications it may perform. Table 1 shows the UV values for all species. Numerous informants have given *Zizyphus oenoplia* (UV-1.8) a high rating, followed by *Terminalia bellirica* (UV-1.6), *Terminalia chebula* (UV-1.6), *Acacia caesia* (UV-1.4) and *Aegle marmelos* (UV-1.4). Low UV levels indicated that the plant species were only used for a few particular illnesses (33) or those individual plants were less well-known in the study area (34).

Relative Frequency Citation (RFC)

The use of plant species revealed by informants in the field was used to calculate RFC. In other words, the number of applications for a given plant species increases as the number of informants increases. *Piper longum* (RFC-1.0) and *Syzygium aromaticum* (RFC-1.0) were the most often used plant species, followed by *Aegle marmelos* (RFC-0.8), *Cuminum cyminum* (RFC-0.8), *Glycyrrhiza glabra* (RFC-0.8), *Leucas aspera* (RFC-0.8), *Madhuca longifolia* var. *latifolia* (RFC-0.8), *Nigella sativa* (RFC-0.8), *Piper nigrum* (RFC-0.8) and *Rauvolfia serpentina* (RFC-0.8) because of their therapeutic efficacy, and UV levels were also high (Table 1). Nearly 86 plant species had the lowest score (RFC-0.2), indicating that informants disagreed with the therapeutic benefit of these plants, which are only utilised by a few informants in this area and have lower UV (35).

Family Use Value

The plants utilised in the therapy were obtained from the wild and belonged to 136 genera and 65 families, according to the research, which included 160 species. Leguminosae

or Fabcaeae (17 species) was the most species-dense family, followed by Rubiacaeae (9 species), Apocyanaceae (7 species), Myrtaceae (7 species), and Lamicaeae (7 species). However, a small number of Plumbaginaceae (5), Rhamnaceae (5), and Combretaceae (4.2) species were utilised in a greater number of diseases, resulting in a high FUV when compared to a family with a large number of species (Fig. 2).

because of their year-round availability of components (bark, leaf, root, flower and seeds).

Percentage of Plant species used

The proportion of plant species employed reveals how many plant species are used to treat a certain ailment by practitioners. For a total of 39 illnesses, all informants report a total of 160 plant species. Plant species used to treat neurological disease (67.5%), gynaecological and

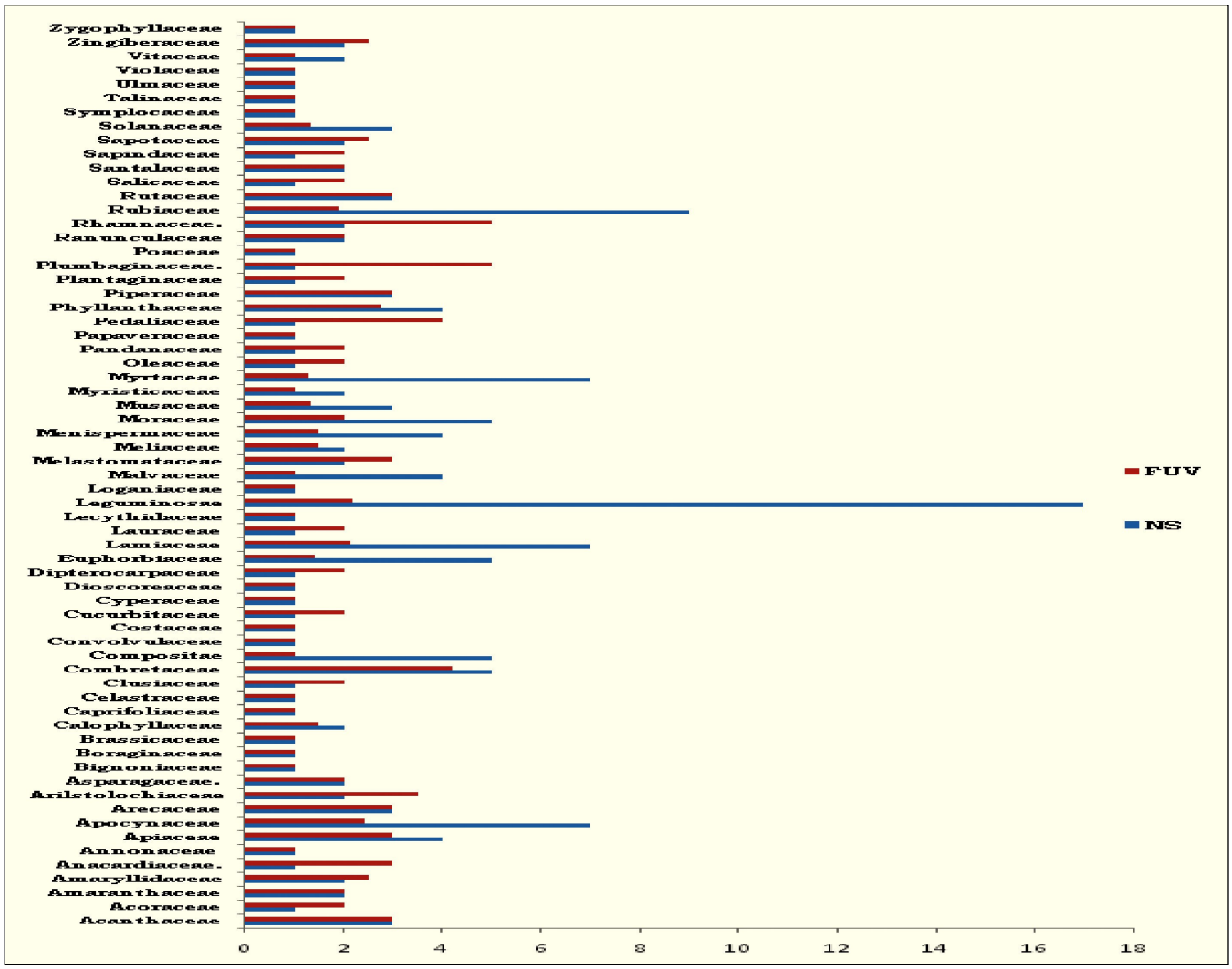

Fig. 2. Number of species (NS) and family use value.

Consensus value for Plant Part (CPP)

The roots (CPP-19.7 %), leaves (CPP-19.7 %) and bark (CPP-19.2 %) were the most often employed plant components in medication compositions in the research region, according to practitioners' degree of agreement among informants. The CPP values for the three plant parts above were virtually equal, indicating that the healer prioritised three of them above the others. The stem, rhizome, bulb, flower, fruit, seed, resin, thorn, oil and aril were all utilised in little amounts by informants (Fig. 3).

Percentage of Habit Used

According to a habit-wise research, the majority of practitioners chose tree species (35.6%), followed by herbs (31.8%), shrubs (16.2%) and climbers (16.2%). (12.5%). Informants are less likely to utilise creepers (2.5%) and lianas (1.9%) (Fig. 4). The majority of healers picked tree species

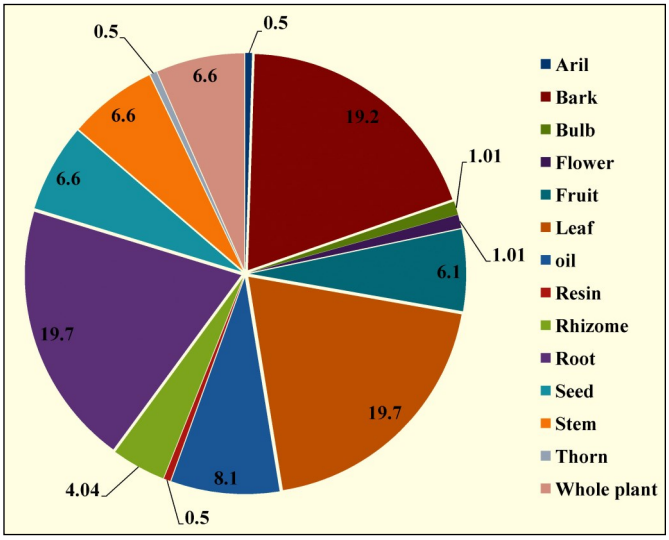

Fig. 3. Percentage of plant part used in medicine.

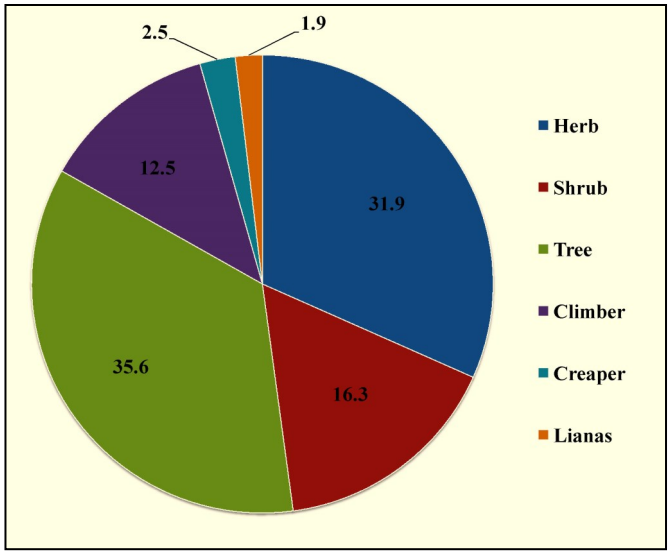

Fig. 4. Percentage of habit used for medicine.

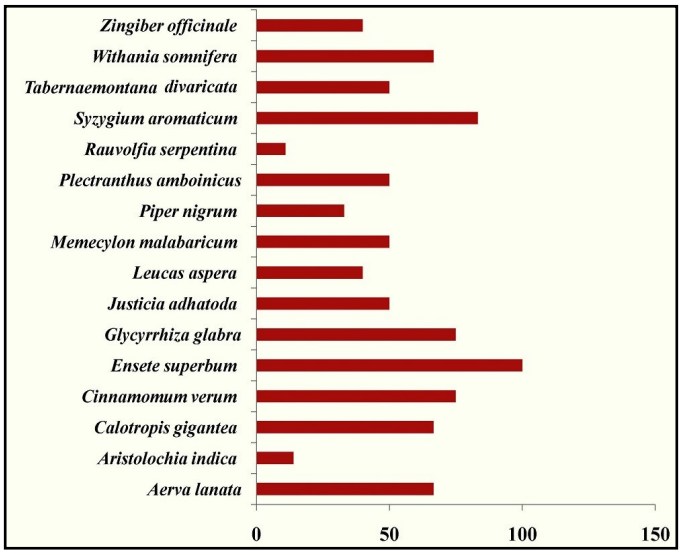

Fig. 6. Plant shows fidelity level for specific ailment.

andrological disease (25%), gastrointestinal disease (24.3%), dermatological disease (20%), pain (16.8%), respiratory disease (11.8%) and urological disorders (11.8%). (9.3 %). Antidote (2.5%) and ophthalmological diseases (2.5%) were recorded. In Fig. 5, paralysis (62.5%), Asthama (11.8%), Children's Massage oil (9.3%) and Herpes (8.1%) are the individual ailment with the largest number of species used.

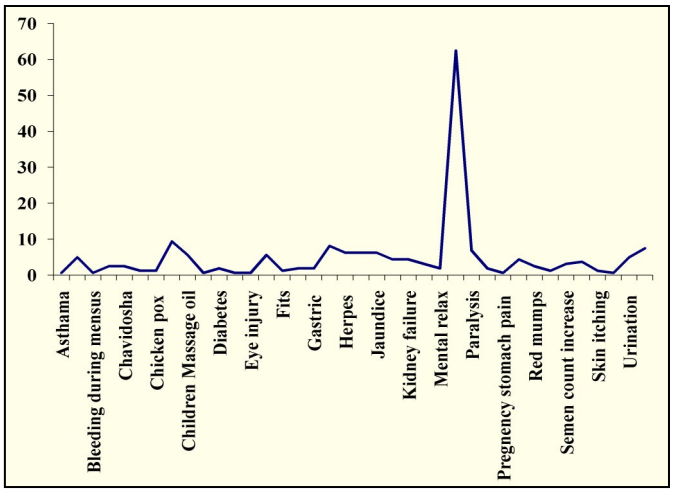

Fig. 5. Percentage of plant species used for different ailment.

Fidelity Level

In general, the fidelity level is used to calculate each plant's relative value for each disease. For this reason, we analysed the data, selecting species with only one application. *Syzygium aromaticum* (FL-83.3%), *Cinnamomum verum* (FL-75%) and *Glycyrrhiza glabra* (FL-75%) were utilised specifically for Neurological disorders. For Gynaecological and Andrological illness, *Withania somnifera* (FL-66.6 percent) and *Tabernaemontana divaricata* (FL-50 %) were commonly utilised. For Urological issues, species like *Ensete superbum* (100%) and *Aerva lanata* (66%) were utilised exclusively. Dermatological illness was treated using *Memecylon malabaricum* (50%) and *Plectranthus amboinicus* (50%) plants. Antidote was made from plant species with the lowest FL value, *Aristolochia indica* (14%) and *Rauvolfia serpentina* (11%) (Fig. 6). The higher the FL value, the more frequently the species is used or the more successful it is in treating a particular disease, and the lower the FL value, the less frequently the species is used or the less effective it is at treating that particular ailment. In other words, choosing informants with specific illnesses yielded the highest FL value, whereas choosing informants with a wide range of illnesses yielded the lowest FL value (36).

Informants Consensus Factor (ICF)

The degree of agreement among informants on their knowledge of a given disease is determined using this consensus technique. To put it another way, calculate the percentage of information shared across informants about a certain ailment. All informants reported 382 times of usage, resulting in a total of 39 illnesses. The ICF values for each category are presented. Disease was divided into nine unique groups referred to as use categories. The ICF values obtained for each category explained how much information about a certain ailment was shared by informants (37). When compared to pain (0.03), ophthalmological illnesses (0.0) and respiratory disease (0.11), the ICF scores of neurological disease (0.36), dermatological disease (0.35), antidote (0.25), gynaecological and andrological disease (0.18), urological problems (0.17) and gastrointestinal disease (0.11) were moderately high (-0.2). According to the findings, neurological sickness (0.36) and dermatological disease (0.35) have comparably high values (near to 1.0), implying that a large number of respondents utilise fewer plant species or that information about certain ailments is well shared among informants (Fig. 7). The low ICF (0.1) result suggests that the informants differ about which species should be employed for specific illness category. In other words, the informants in this field commonly treat neurological and dermatological diseases. In various areas, the ICF value of different use categories differs. Childhood stubbornness, mental relax, migraine, paralysis and epilepsy are five forms of neurological illnesses. This category has 169 total usage reports, with 19 practitioners acknowledging them. Plant species are employed to treat neurological disorders in 68 % plant species (108 plants). 100 species of medicinal plants are used only for paralysis, out of a total of 108. All informants employed plant species such as

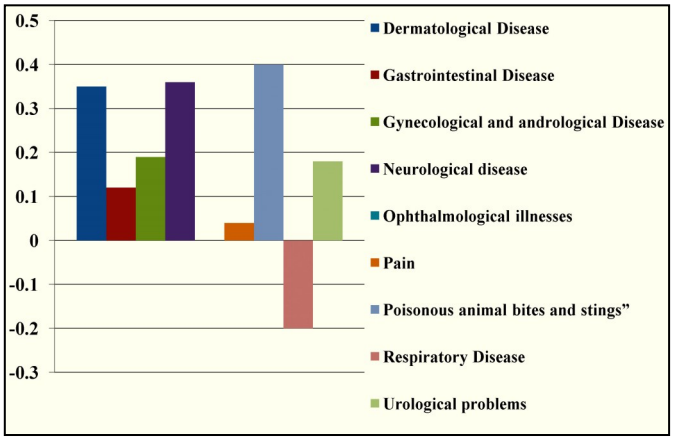

Fig. 7. Informants consensus factor for different use category.

Syzygium aromaticum (FL-83.3%), *Cinnamomum verum* (FL-75%), and *Glycyrrhiza glabra* (FL-75%) for paralysis out of a total of 100 plants (Fig. 6). The high value of ICF and FL shows that practitioner's paralysis information exchange successfully, resulting in practitioners employing the same plant species for paralysis.

Magico-religious and spiritual practices

Traditional Nalike healers learned magicao-religious rites from their predecessors through "Daivaradane" or "Bhootha kola," or the worship of indigenous deities. Specific songs (prayer in Tulu) are used in conjunction with dancing during "Daivaradhane" or "Bhootha Kola" to call specific "Daiva" or "Bhootha" (Deities). As a result, traditional healers in this culture use spiritual and magicalo-religious procedures to cure patients, such as chanting "Mantras," applying "Bhasma," tying sacred threads, healing spirits (negative energy) and casting away the evil eye (drushti). People in the community believe in such endeavours. Traditional remedies in India have links to spiritual and magico-religious procedures that are practised. India is well-known across the world for its spiritual culture and traditional medicines in the nation have ties to spiritual and magico-religious rites that are practised. Similar proceedures for the treatment of mental patients have been documented in the Indian state of Tamil Nadu (38, 39).

Discussion

According to the current research, traditional practitioners of the Nalike community of Banta taluk of Dakshina Kannada district treat a variety of ailments, with paralysis being the most common. According to the current research, 100 plant species belonging to 49 families and 90 genera account for 62.5 % of plant species used for paralysis (40-43).The Nalike community employed *Syzygium aromaticum* (FL-83.3%), *Cinnamomum verum* (FL-75%), and *Glycyrrhiza glabra* (FL-75%). Traditional healers in Badravathi taluk utilised *Embilia ribes* and *Withania somnifera* (43), Gadag district *Sesamum indicum*, *Brassica nigra*, *Tamarindus indica*, *Clerodendrum phlomidis*, *Calotropis gigantea* (44) and Vellore region of Tamilnadu *Rubus ellipticus* and *Solanum xanthocarpum* for paralysis (45). Traditional practitioners in various research locations use different plant species for paralysis as a consequence of indigenous knowledge and readily available botanicals. In this study, the ICF and FL values are high, showing that practitioners' paralysis knowledge is well exchanged, as evidenced by their usage of the same plants for paralysis therapy.

Conclusion

In order to understand more about their cultural competence, twenty-five traditional healers from the Nalike Community (tribe) were questioned for this study. There are 160 plant species in 65 groups that can be used to cure 39 different illnesses. Paralysis is a frequent condition (high ICF value) that is addressed by everyone, with 62.5% (highest percentage of plant species employed) being commonly used to treat health concerns. For paralysis, healers employed *Syzygium aromaticum* (FL-83.3 %), *Cinnamomum verum* (FL-75 %) and *Glycyrrhiza glabra* (FL-75 %). Herbal paralysis medications were offered in the form of decoctions, tablets, pastes and oils. Traditional healers apply oil to the damaged area and perform spiritual and magicalo-religious rituals on a regular basis at the healer's home, clinic or the patient's home.

Acknowledgements

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Authors contributions

Mr. Manohara Acharya compiled the information and wrote the paper. The data were interpreted with help from Dr. Ravindra B Malabadi and Mr. Divakar M S. Dr. Raju Krishna Chalannavar conceptualised the study and managed its implementation and planning. All of the writers evaluated the findings, and they all contributed significantly to the final publication.

Compliance with ethical standards

Conflict of interest: The authors state/declare that they have no known financial or personal conflicts of interest that might have influenced the work reported in this publication. "None" when it comes to ethical dilemmas.

Ethical issues: None.

Supplementary data

Table 1 List of plants used by Nalike Community

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