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Quantitative analysis of medicinal plants used to treat musculoskeletal ailments by non-institutionally trained *siddha* practitioners of Virudhunagar district, Tamil Nadu, India

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ABSTRACT

Background: *Siddha* is one of the traditional medical systems of India; previous ethnobotanical survey in Virudhunagar district indicated a high consensus for treating musculoskeletal ailments.
Objectives: This study was aimed to quantitatively document the medicinal plants used to treat musculoskeletal ailments by non-institutionally trained *siddha* practitioners of Virudhunagar district, Tamil Nadu, India.
Materials and methods: This work was the outcome of free-list interviews conducted among 45 informants between April 2016 and January 2017. Sampling sufficiency was assessed by plotting Shannon –Wiener's index and cumulative number of UR. Informant consensus was assessed using Informant Consensus Factor (F_{ic}) and Informant Agreement Ratio (IAR).
Results: This study recorded the data regarding 116 plant species which were used to prepare 129 formulations; analysis of the data yielded 490 UR. Among these, 65.3% of UR dealt with internal applications and 34.6% dealt with external applications. In the case of internally used formulations, pain and general musculoskeletal ailments had high F_{ic} values. In the case of externally used formulations, headache and pain had high F_{ic} values.
Conclusion: Important species prescribed by the informants to treat various musculoskeletal ailments were: *Azima tetracantha, Ricinus communis, Sesamum indicum, Moringa oleifera, Cardiospermum halicacabum* (internal application), *Calophyllum inophyllum, Justicia adhatoda, Curcuma longa, Calotropis gigantea, Zingiber officinale, Withania somnifera, Strychnos nux-vomica, Dodonaea viscosa* (external application), *Azadirachta indica, Clerodendrum phlomidis, Delonix elata, Pergularia daemia* and *Vitex negundo* (internal and external applications). Robust studies on these local claims will help to improve the community healthcare and will yield some novel agents to treat musculoskeletal ailments.

1. Introduction

Traditional medicine system is defined as the accumulated therapeutic experiences of generations [1]; it is still used by about 75–80% of the world population for primary health care [2]. In India various traditional healthcare systems are available and it includes the use of about 7000 species of flowering plants [3]. *Siddha* is one of the important traditional medical systems of India majorly practiced in Tamil Nadu and its fringes [4]; it is also practiced in other countries such as Sri Lanka, where the *Tamil* people live.

According to the *siddha* doctrine, the human body is made up of 96 principles (*thattuvam*). Among them, three humors namely *vātā* (≃ air), *pitta* (≃ fire) and *kapa* (≃ water) are considered as important principles for health. Any imbalance among them causes illnesses. The *vātā* humor maintains all the movements of the body such as movement of organs, reflexes, functional co-ordination, etc. Any derangement in this humor in a particular organ will show the characteristics of pain, debility, tremor, rigidness and loss of

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function in the related organs and these changes are termed as *vātā* ailments. *Siddha* literature describe about eighty fives types of *vātā* diseases [5,6]; most of them were the musculoskeletal ailments and few other illnesses like hernia were also categorized under this group in the traditional literature. These ailments are one of the important illnesses treated by the *siddha* system of medicine; our previous study in the same area showed high informant consensus for this illness category [7].

Musculoskeletal disorders (MSD) are the second largest cause of disability [8], impacting the individuals and their prevalence is increasing with age [9].The prevalence of MSD in India was calculated as 6.4–23.6% [10] and it was the most common self-reported illness. Two-third of MSD subjects in India were reported to suffer from non-specific pain and arthralgia [11]. An US based survey between 1992 and 2010 indicated that MSD accounted for about 29–35% of all occupational illnesses involving days away from work [12]. According to a survey musculoskeletal pain nearly affects one in every four adults and the annual cost of managing pain ranged from 560 to 635 billion dollars for the United States [13]. Further, MSD was identified as one of the most common causes for seeking self-medication. The use of complementary and traditional therapies in the management of MSD is reasonably common globally and a survey in India conducted among dentists indicated that about 70% of subjects with MSD use only these alternate therapies [14]. The importance of training traditional healers for the management of MSD in India was also reported by previous studies [15]. In this survey, we quantitatively documented the medicinal plants used by the non-institutionally trained *siddha* practitioners of Virudhunagar district to treat the musculoskeletal ailments. It also documented the formulations for few non-MSD like hernia, testicular pain since they were also considered as one among the *vātā* ailments.

2. Methodology

2.1. Study area

Virudhunagar district is located in Tamil Nadu with an area of 4288 km^2 (Fig. 1). It is bounded by Madurai, Thoothukudi and Theni districts in Tamil Nadu and by Kerala state in the west. The district has a mixture of rural and urban populations; the rural population is 49.5%. This district comprises eight *taluks* (sub-districts) namely Aruppukkottai, Kariapatti, Thiruchuli, Rajapalayam, Srivilliputtur, Sivakasi, Sattur and Virudhunagar. The population density of this district is 458 inhabitants/km^2 and the gender ratio for females to males is 1.7:1.0. The total literacy rate of Virudhunagar district is 80.1%; the female literacy rate is 65.5%. Forests in this district are found on the eastern slopes of the Western Ghats and they occupy only 6.3% of geographical area of this district. Agriculture is the major source of revenue in rural parts, while printing and cracker industries are the major source of revenue in the urban areas. The State Government is providing *siddha* treatment in nine hospitals and 16 Primary Health Centers with 31 institutionally trained *siddha* practitioners (Anonymous, 2010). Nearly 126 non-institutionally trained *siddha* practitioners and 97 folk healers are practicing in this district [7].

2.2. Interviews

The field survey was conducted from April 2016 to January 2017. The non-institutionally trained *siddha* practitioners were identified with the help of the elders in the study area. Only the practitioners who were treating musculoskeletal ailments for more than five years and gave consent to participate in the interview were included in the survey. The aims and objectives of the study were explained in lay terms before the start of the interview and the informants were explained that they had the right to stop the interview at any time. The first two visits were used to explain these details and the formal interviews were conducted from the subsequent visits [16]. All the protocols were reviewed and approved by the Institutional Ethics Committee for Ethnobiology Research (ERI/IEEC/15/02) and the field surveys were conducted by SE, SM and PP. This interview includes the ethnomedical data obtained from 45 non-institutionally trained *siddha* practitioners of Virudhunagar district who gave written consent to share their knowledge.

The methodology used for this study is successive free-listing method [17] to collect the data. The questionnaire consisted of two parts. The first part dealt with the demography of the informants and the second part dealt with their knowledge on the medicinal plants used for treating musculoskeletal ailments. In the second part, the informants were asked about the formulations given to treat musculoskeletal ailments, their ingredients, parts used with measures, mode of preparation, illnesses treated with their symptomatology, dose and duration; all these were documented. The interviews and the data were gathered through the local language, *Tamil* and the data were translated into English in the laboratory. Equivalent English terms for the illnesses were fixed by correlating the *Tamil* terminologies and symptoms with the biomedical literature by one of the authors of this communication (PE), who is an institutionally trained *siddha* practitioner.

2.3. Specimens

Collected plant specimens or raw drugs were identified through examination of voucher specimens and the binomial names for the species were fixed using local floras [18–21] and the valid correct names were confirmed with a website (http://www.theplantlist.org/). The plant specimens and raw drugs were stored at the herbarium of Entomology Research Institute, Loyola College, Chennai.

2.4. Data analysis

The illnesses were grouped into illness categories on the basis of *siddha* literature. The data on medicinal plants were converted into use-reports (UR) in accordance with the previously published methodology [22]. Sampling sufficiency of the survey was assessed by plotting Shannon Wiener's index, which was calculated using PAST3 program; cumulative number of use-reports and attaining a clear asymptote of the curve are considered as indicators of sampling sufficiency. The data were grouped into external and internal formulations. Informant consensus factor (F_{ic}) was calculated for external and internal formulations separately under each illness category using the following formula.

$$F_{ic} = (N_{ur} - N_t) / (N_{ur} - 1)$$

Where N_{ur} is the number of UR for a particular illness category, and N_t is the total number of species mentioned for that particular illness category. This factor ranges from zero to one, where increasing values indicate high rate of informant consensus. To assess the importance of individual species in each illness category Index of Agreement on Remedies (IAR) was calculated using the following formula

$$\text{Index of Agreement on Remedies (IAR)} = n_{ur} - n_a / n_r - 1$$

Where n_{ur} is the total number of UR registered for species and n_a is the number of illness categories that are treated with that species.

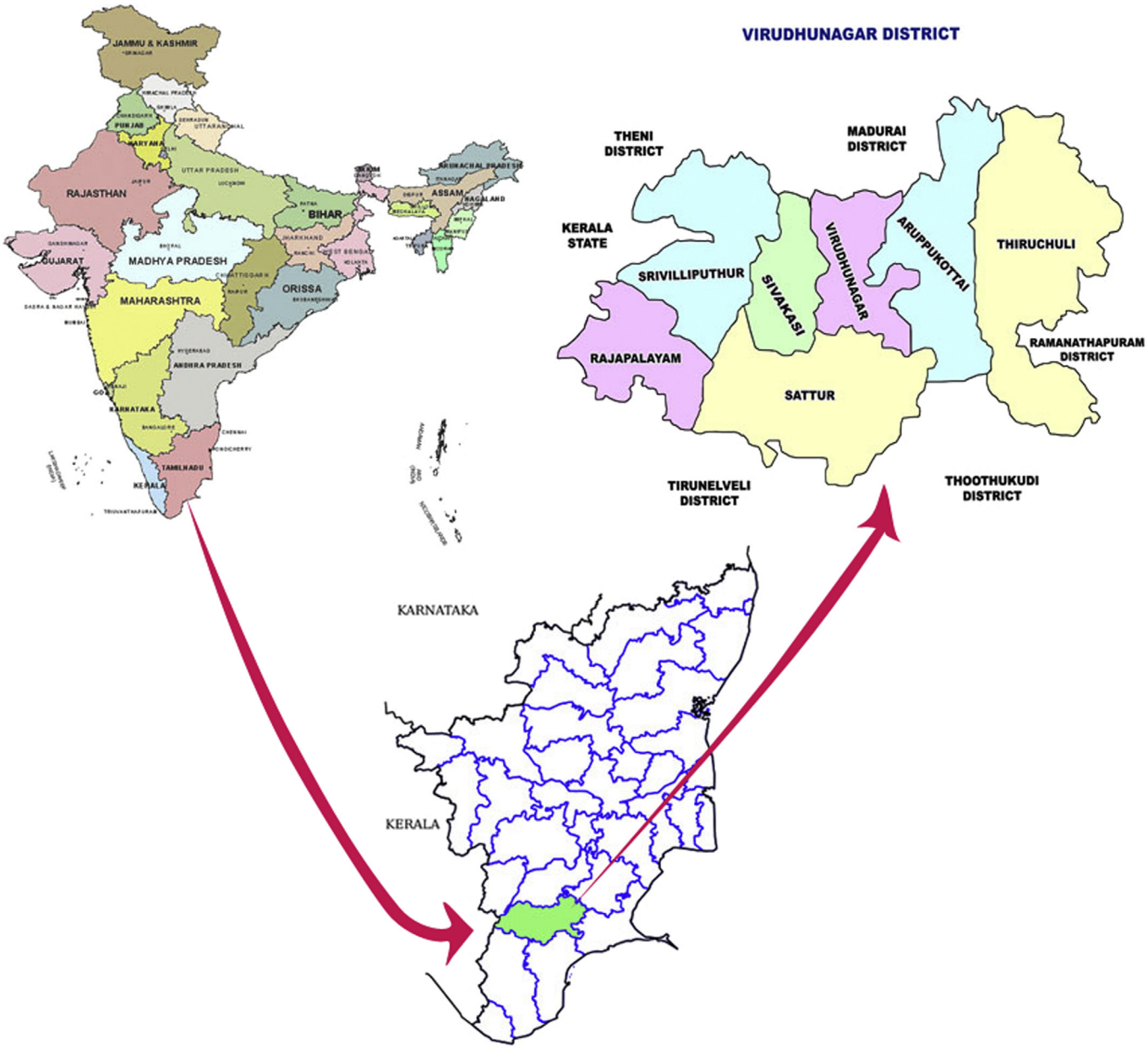

Fig. 1. Map of the study area.

3. Results

3.1. Demography of the informants

Analysis of the demography of the informants indicated that 78% of the informants were above 50 years of age and all are belonging to male gender. All informants completed only primary or secondary school education. The major way of non-institutional knowledge transmission was master and disciple method; all the informants were full time practitioners and 67% of the informants had >20 years of experience (Table 1).

3.2. Quantification of the data

This survey is the outcome of 45 interviewing non-institutionally trained *siddha* practitioners of Virudhunagar district of Tamil Nadu. The data regarding the different musculoskeletal ailments closely related English terms and illness categories under which they are grouped are given in Table 2. The data regarding the formulations used by the informants to treat various musculoskeletal ailments are given in Table S1. Plotting species richness curve indicated that the sampling was sufficient for data analysis (Fig. 2). This study recorded the data regarding 129 traditional *siddha* formulations used to treat various musculoskeletal ailments and analysis of the data yielded 490 UR. Among these UR, 320 (65.3%) dealt with internal applications and 170 (34.6%) dealt with external applications. Conversion of UR to claims yielded 345 claims and 231 (66.9%) claims dealt with internal uses. Only 25 (10.8%) and 20 (17.5%) claims had minimum two URs for internal and external uses, respectively. The rest of the claims were singletons (Tables 3 and 4).

This study recorded the use of 116 species to treat various musculoskeletal ailments. Among them, 49 (42.2%) species were reported for internal uses; 32 (27.5%) were reported for external uses and 35 (30.1%) were reported for both external and internal

Table 1
Demographic profile of the informants shared their knowledge for this study.

Attributes	Number	Percentage
Age		
45–50	10	22.22
51–60	18	40
61–65	10	22.22
Above 66	7	15.55
Gender		
Male	45	100
Education		
Primary school	16	35.55
Secondary school	29	64.44
Mode of learning		
From family members	12	26.66
From traditional practitioners	33	73.33
Experience		
20 years	15	33.33
21–30	10	22.22
30–45	20	44.44
Occupation		
Full time practitioners	45	100

uses. In the case of species used only internally, *Plumbago indica* had high number of UR. In the case of species used only for externally usage, *Cocos nucifera* had high number of UR. *Zingiber officinale* had high number of UR in the case of plants used both externally and internally. The illness categories were grouped arbitrarily into three groups viz., illness categories having high, average or low F_{ic} values [23,24]. The illness category, pain had highest overall F_{ic} value, followed by general musculoskeletal ailments.

3.3. Quantification of internally used formulations

In this category, pain and general musculoskeletal ailments had obtained high F_{ic} values, compared to the others. The illness categories like flatus, stiffness, *vātā* of scrotal region, paresis and spasm had average F_{ic} values. *Z. officinale* obtained 12 UR for pain followed by *Allium sativum*. In the illness category of pain, the plants such as *Saussurea costus, Senna auriculata* and *Delonix elata* had high IAR values. In the case of plants given to treat general musculoskeletal ailments *Piper nigrum, Z. officinale* and *A. sativum* also got high number of citations. In this category, *Clerodendrum phlomidis, D. elata* and *Vitex negundo* had high IAR values. The plants with high number of citations for illness categories with average F_{ic} values were: *P. nigrum* (flatus and stiffness), *A. sativum* (*vātā* of scrotal region), *Azima tetracantha* (paresis) and *Z. officinale* (spasm). The remaining illness categories got low F_{ic} values.

3.4. Quantification of externally used formulations

In the case of externally applied formulations, headache got high F_{ic} value followed by pain and general musculoskeletal ailments. Swelling and arthritis had average F_{ic} values. In the case of headache, coconut oil was used to prepare many formulations and got

Table 2
Local terminologies of various musculoskeletal ailments reported by the informants with equivalent English terms.

S. No.	Local Name	Equivalent English terms	Illness category
1	*Aṇṭavātam*	Inflammation and swelling of the testicles	*vātā* of scrotal region
2	*Ārampa vātanōy*	Early stage of musculoskeletal ailments	General musculoskeletal ailments
3	*Iṭuppuvali*	Lumbosacral pain	Pain
4	*Iḷampiḷḷai vātam*	Poliomyelitis	Poliomyelitis
5	*Uṭalvali*	Body pain	Pain
6	*Orupakkat talaivali*	Hemicrania	Pain
7	*Kaḻuttuvali*	Pain in the neck	Pain
8	*Kālvali*	Pain in the leg	Pain
9	*Kīlvātam*	Arthralgia	Arthritis
10	*Kuṭalvātam*	Hernia	Hernia
11	*Kuṭaiccal*	Nagging pain	Pain
12	*Kai, kāl kuṭaiccal*	Nagging pain of all the limbs	Pain
13	*Kai, kāl vali*	Pain in upper and lower limbs	Pain
14	*Carvāṅka vātam*	Quadriplegia	Paresis
15	*Cūlai*	Lancinating pain	Pain
16	*Talaivali*	Headache	Pain
17	*Timirvātam*	Spasm resulting from numbness	Spasm
18	*Tōḷpaṭṭaippiṭippu*	Rheumatism of the Shoulder	Rheumatism
19	*Naṭukkuvātam*	Parkinsonism	Parkinsonism
20	*Narampuppiṭippu*	Contraction of a nerve or muscle	Spasm
21	*Pakkavātam*	Hemiplegia	Paresis
22	*Pāricavāyu*	Paresis	Paresis
23	*Piṭari icivu*	Spasm in the shoulder	Pain
24	*Piṭarivali*	Pain in occipital region	Pain
25	*Piṭippu*	Stiffness	Stiffness
26	*Maṇṭaikkuttu*	Boring headache	Pain
27	*Mārpuvali*	Chest pain	Pain
28	*Muṭakkuvātam*	*Arthritis*	Arthritis
29	*Muḻaṅkāl vali*	Pain in the knees	Pain
30	*Mūccuppiṭippu*	Pain during breathing	flatus
31	*Mūṭṭuvali*	Pain in the joints	Pain
32	*Vāta aḻaṟci*	Inflammation due to vitiated *vātā* humour	Inflammation
33	*Vāta vali*	Pain due to vitiated *vātā* humour	Pain
34	*Vāta vīkkam*	Swelling due to vitiated *vātā* humour	Swelling
35	*Vātakkaṭuppu*	Pain due to vitiated *vātā* humour	Pain
36	*Vātam aṉaittum*	All types of *vātā* ailments	General musculoskeletal ailments
37	*Vāyuppiṭippu*	Stiffness due to flatus	flatus
38	*Vitai vīkkam*	Testicular Swelling	*Vātā* of scrotal region
39	*Vitaivātam*	Pain in testicles	*Vātā* of scrotal region
40	*Vīkkam*	Oedema	Swelling

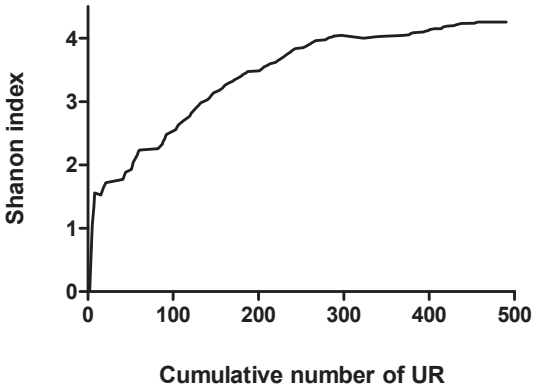

Fig. 2. Assessing sampling sufficiency using species accumulation curve.

high number of UR. The plants such as *Curcuma longa*, *Gmelina asiatica*, *V. negundo*, *Sesamam indium*, *Z. officinale* and *Calotropis gigantea* had high IAR values in this group. In the case of pain, the oils of *Ricinus communis* and *Azadirachta indica* had high F_{ic} values for external applications. The plants such as *Withania somnifera, Dodonaea viscosa* and *C. phlomidis* had high IAR values for the treatment of pain. In the case of plants prescribed for general musculoskeletal ailments, *C. phlomidis* had high number of UR and *Justicia adhatoda* had high IAR value.

4. Discussion

Many ethnobiological surveys indicated a positive correlation between the age and increased knowledge on traditional medicine. The informants of this survey indicated that most of the informants were above 50 years of age and had above 20 years of experience. Our previous survey in the same study area documented that this practice was majorly a male dominant domain and it was also reflected in this survey. The master to disciple mode of knowledge transmission was predominant in this system than father to son knowledge transmission. During the field work, it was noticed that few disciples were working with the informants and they were allowed to observe and assist the informants in collecting herbs, preparing the formulations and treatment.

Low back pain and chronic joint pain were reported as the most common musculoskeletal conditions [25] and their prevalence was increasing with age [26]. An UK based study showed that NSAIDs were taken by one in every five people between the ages 65 and 74 for the management of pain [27]. In India, the use of analgesics particularly herbal based were reported as the first choice by the patients for the management of pain [28].

This survey reported the high use of *P. nigrum, Z. officinale* and *A. sativum* for the management of general musculoskeletal ailments, pain, stiffness of joints and flatus. Ginger is also reported as an anti-inflammatory herb in *Ayurveda* and Chinese systems of traditional medicine. The major phytochemical constituents of ginger such as gingerols and shogalos were reported to interfere with leukotriene, interleukins, cyclooxygenase and TNF-α metabolisms [29]. A small, randomized controlled trial with 43 subjects with osteoarthritis indicated that the supplementation with ginger based combination significantly reduced the pain and had gastro protective effect, compared to diclofenac [30]. Another double-blinded randomized clinical trial with 440 patients with systematic osteoarthritis also indicated that the supplementation of a ginger containing formulation for 24 weeks significantly reduced pain and improved knee function [31]. Short term study with normal subjects indicated that ginger supplementation did not affect the visual analog scale of pain [32]. Though studies showed a reduction in the subjective experience of pain with ginger supplementation, robust studies are needed to establish the analgesic activity of ginger [29]. No clinical reports were available for the analgesic effect of garlic.

Some studies were conducted on the species such as *P. nigrum, Moringa oleifera* and *R. communis* cited by the informants for the management of pain. A small, double-blinded randomized clinical trial with 54 patients with systematic osteoarthritis indicated that the supplementation of essential oil of *P. nigrum* for nine weeks significantly reduced pain [33]. Some preclinical experiments also reported the analgesic effect of pepper and piperine [34]. Likewise, few animal reports indicated the analgesic effect of *M. oleifera* [35,36]; however no clinical report was available. A small, randomized clinical trial with 30 patients with systematic osteoarthritis indicated that the supplementation of root powder of *R. communis* for 30 days significantly reduced pain [37]. In the illness category pain, *S. costus* and *S. auriculata* had high IAR values; however no clinical data is available on the efficacy of these two species. Some anti-inflammatory constituents such as 3,4-dihydrobenzoic acid from *V. negundo* [38], 3-hydroxy, 2-methoxy-sodium butanoate [39] and hesperidin from *D. elata* [40] were also reported; however these plants lack rigorous studies.

A preclinical experiment with nitroglycerine induced migraine in rats indicated the beneficial effect of oral curcumin treatment [41]. In a double blind placebo controlled study with 60 adult migraine subjects indicated the use of oral ginger treatment [42]. In subjects with chronic osteoarthritis, topical ginger application

Table 3
Informant Consensus Factor (F_{ic}) for different musculoskeletal ailments.

Illness categories	Total			Internal			External		
	N_{UR}	N_S	F_{ic}	N_{UR}	N_S	F_{ic}	N_{UR}	N_S	F_{ic}
Arthritis	20	19	0.052	4	4	0.000	16	15	0.066
Flatus	15	11	0.285	15	11	0.285	0	0	–
General musculoskeletal ailments	107	49	0.547	75	49	0.351	32	20	0.387
Headache	28	14	0.535	1	1	0.000	27	13	0.538
Hernia	8	8	0.000	8	8	0.000	0	0	–
Pain	177	81	0.542	112	59	0.477	65	37	0.437
Paresis	20	18	0.105	20	18	0.105	0	0	–
Parkinsonism	19	19	0.000	19	19	0.000	0	0	–
Poliomyelitis	1	1	0.000	1	1	0.000	0	0	–
Rheumatism	1	1	0.000	0	0	–	1	1	0.000
Spasm	18	17	0.058	18	17	0.058	0	0	–
Stiffness	37	29	0.222	37	29	0.222	0	0	–
Swelling	24	23	0.043	0	0	–	24	23	0.043
Vātā of scrotal region	15	13	0.071	10	9	0.111	5	5	0.000

N_{UR} – Number of Use Reports; N_S – Number of Species; '–' indicates F_{ic} values were not calculated for that illness categories.

Table 4
List of important plant species cited by the non-institutionally trained *Siddha* practitioners of Virudhunagar district, Tamil Nadu to treat musculoskeletal ailments.

S.No	Illness categories	Internal	External
1	Arthritis	–	*Calophyllum inophyllum* (1.00)
2	Flatus	*Piper nigrum* (0.64), *Allium sativum* (0.60), *Zingiber officinale* (0.65)	–
3	General musculoskeletal ailments	*Piper nigrum* (0.64), *Zingiber officinale* (0.65), *Allium sativum* (0.60), *Azadirachta indica* (0.62), *Trachyspermum ammi* (0.29), *Vitex negundo* (0.73), *Acorus calamus* (0.17), *Clerodendrum phlomidis* (0.86), *Delonix elata* (0.77), *Pergularia daemia* (0.60), *Piper longum* (0.37), *Plumbago indica* (0.33), *Ricinus communis* (0.67), *Sesamum indicum* (0.73)	*Clerodendrum phlomidis* (0.86), *Vitex negundo* (0.73), *Azadirachta indica* (0.62), *Delonix elata* (0.77), *Ricinus communis* (0.67), *Justicia adhatoda* (1.00)
4	Headache	–	*Cocos nucifera* (0.50), *Curcuma longa* (1.00), *Calotropis gigantea* (0.60), *Gmelina asiatica* (1.00), *Plumbago zeylanica* (0.33), *Sesamam indium* (0.67), *Vitex negundo* (0.73), *Zingiber officinale* (0.66)
5	Pain	*Zingiber officinale* (0.66), *Allium sativum* (0.60), *Piper nigrum* (0.64), *Delonix elata* (0.77), *Moringa oleifera* (0.62), *Ricinus communis* (0.67), *Alpinia calcarata* (0.33), *Cardiospermum halicacabum* (0.50), *Piper longum* (0.37), *Plumbago indica* (0.33), *Syzygium aromaticum* (0.43), *Azima tetracantha* (0.50), *Brassica juncea* (0.50), *Citrus limon* (0.50), *Ferula foetida* (0.17), *Pongamia pinnata* (0.25), *Saussurea costus* (1.00), *Senna auriculata* (1.00), *Sesamum indicum* (0.73), *Strychnos nux-vomica* (0.60), *Vitex negundo* (0.73)	*Ricinus communis* (0.67), *Azadirachta indica* (0.62), *Pergularia daemia* (0.60), *Brassica juncea* (0.50), *Vitex negundo* (0.73), *Sesamam indium* (0.64), *Withania somnifera* (1.00), *Strychnos nux-vomica* (0.60), *Dodonaea viscosa* (1.00), *Clerodendrum phlomidis* (0.86), *Calotropis gigantea* (0.60)
6	Paresis	*Azima tetracantha* (0.50), *Delonix elata* (0.77)	–
7	Spasm	*Zingiber officinale* (0.66)	–
8	Stiffness	*Piper nigrum* (0.64), *Zingiber officinale* (0.67), *Allium sativum* (0.60), *Plumbago indica* (0.33), *Ricinus communis* (0.67), *Syzygium aromaticum* (0.43),	–
9	Swelling	–	*Azadirachta indica* (0.62)
10	*Vātā* of scrotal region	*Allium sativum* (0.60)	–

The plant species under each illness category were arranged in descending order on the basis of UR for that particular illness category; Values given between parentheses indicate the IAR value.

relieved the symptoms and increased the independence [43]. In many traditional systems of medicine the uses of *V. negundo* [41] and *Calotropis procera* [44] to treat headache were reported. A double blind study with sixty subjects with knee pain indicated the efficacy of *W. somnifera* [45]. Topical anti-inflammatory drugs and painkillers have been reported as one of the widely used formulations, having better pain relief with minimal adverse events compared to the oral anti-inflammatory agents [46]. This study indicated the use of many plants topically for the management of musculoskeletal ailments. There were scientific evidences and traditional literature support for these species; however scientific studies were limited for their external usage.

5. Conclusion

Studies showed that the global mortality rates were fallen while the rate of disability adjusted life years (DALF) is increasing dramatically. Musculoskeletal disorders such as low back pain are the important causes for the increase of DALF, which in turn impaired the quality of life and loss in working ability. The use of complementary therapies for the management of musculoskeletal health conditions were reported as high, particularly among the veterans and there is a need to scientifically evaluate the traditional claims. The species such as *A. tetracantha* (paresis), *R. communis, Sesamum indicum* (general musculoskeletal ailments), *M. oleifera* and *Cardiospermum halicacabum* (pain) were reported to be used internally to treat various musculoskeletal ailments. The species such as *Calophyllum inophyllum* (arthritis), *Justicia adhatoda* (general musculoskeletal ailments), *Curcuma longa, Calotropis gigantea, Zingiber officinale (headache), Withania somnifera, Strychnos nux-vomica* and *Dodonaea viscosa* (pain) were reported for external applications to treat musculoskeletal disorders. The species such as *Azadirachta indica, Clerodendrum phlomidis, Delonix elata, Pergularia daemia* and *Vitex negundo* were reported for both internal as well as external uses. This study showed that many of the claims had limited clinical evidences and it is important to conduct well-planned, scientifically robust studies to establish the efficacy and safety of these treatments. This study documented that a considerable portion of plants were used externally. Scientific evidences were little for their external application and further robust studies on these claims will yield some novel topical agents for the management of musculoskeletal ailments.

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Conflict of interest

None.

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Appendix A. Supplementary data

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