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Oral traditional plant-based therapeutic applications for pain relief recorded in North Jeolla province, Korea

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This study aims to investigate and announce orally transmitted traditional plant-based therapies for pain relief in North Jeolla Province, Korea. Data was collected with semi-structured questionnaires through the participatory rural appraisal method. This study reveals that overall 23 pain ailments have been treated with a total of 82 species of medicinal plants belonging to 74 genera in 45 families. This study also reports 313 different modes of plant-based therapeutic application of medicinal material. The informant consensus factor for pleurodynia, slipped disk and frozen shoulder is 1.00, the highest among 23 different pain ailments, followed by lumbago, chronic myofascial pain, melosalgia, sinews and joints pain, arthralgia, carpal tunnel syndrome, etc. Medicinal plants with 100% fidelity level and above three mentions among informants were 15 species. This study can help to preserve the traditional knowledge and local health traditions of North Jeolla Province amidst rapid industrialization and urbanization. The findings of this study warrant follow-up clinical research to determine the most effective traditional remedies towards development of herbal medicinal products for integration into the Korean healthcare system. These results will help to prepare the way for advanced research such as new medicines and new therapies that could be of help clinically.

Keywords: Oral traditional knowledge, Pain relief, Fidelity level, Informant consensus factor, Korea

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The significance of genetic resources and its traditional knowledge has increased with the announcement of the Nagoya Protocol in October, 2010[1]. In particular, concern of them will be more widen because of regulations about benefit-sharing as a main content of Protocol.

The traditional knowledge of genetic resources is divided into two parts: recorded knowledge and oral traditional knowledge. Sharing of the benefits is not an issue in the case of recorded knowledge. However, oral traditional knowledge that has not been recorded through investigation and research cannot be acknowledged, in which case it is not subject to benefit-sharing. This fact will fuel the fire for more investigation into traditional knowledge over research on genetic resources which have been studied for a long time[2]. The concern of the researchers about the pain relief using medicinal plants had been getting accomplished variously[3, 4], such as treatment using dietary constituent[5], cancer pain[6], back pain[7, 8, 9], chronic pain[10], rheumatic disease[11], diabetic peripheral neuropathic pain[12] and neck pain[13].

A Parkinson's disease patient by Kim *et al.*[14] is unique as the research of the plant-based traditional therapy for the pain relief in Korea is concerned. However, this is not research about orally transmitted traditional therapy.

Because orally transmitted traditional therapies in developing countries are mostly possessed by the old-age generation, it becomes extinct into the fast speed along with the death of the practitioners[15,16].

Korea was speedily industrialized from the second half of 20 century. Due to this, while the traditional culture and natural ecosystem are destroyed, the orally transmitted traditional therapy rapidly disappears[17, 18, 19, 20]. Particularly, the strong influence of the western medicine accelerates this more. However, the investigation into the orally transmitted traditional therapy is not conducted including the pain relief at all.

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The aim of this study investigates and announces the oral traditional plant-based therapeutic applications about the pain relief for the first time.

Study area and investigative method

Study area

The study area covers the whole region in North Jeolla Province which is the southwest part of the Korean Peninsula. The administrative district consists of sixteen cities and counties (Fig. 1). This region is characterized by a harmonious farming culture of two distinct agrarian styles. The eastern part, approximately 1,000 m above the sea level, is engaged mainly in dry-field farming while having developed a mountainous culture. In contrast, the western part, approximately 100 m under the sea level, has conserved a plain land culture in the paddy-field area. The size of the land is 8,061.41 km^2 [21] and the total population in 2009 was 1,874,521 with a population density of 232.5/km^2 [22].

Investigative method

Field investigation was conducted on 32 sites for 22 months beginning from July, 2008 to May, 2010 (Fig. 1). Data was collected with semi-structured questionnaires through the participatory rural appraisal (PRA) method where the informants served as the investigators at the same time[16, 17, 20]. The contents of the semi-structured questionnaires includes inquiries about ethnopharmacological information of diverse medicinal plants for therapy of pain diseases including local names, plant-parts used, ailments and methods of preparation, manufacturing and administration, dosages, and usable durations[17, 20, 23, 24].

The precise identification of plants as recorded by the informants was performed in accordance with Lee[25] and Lee[26]. All the plant specimens were collected during either their flowering or fruiting seasons and organized using the normal specimen manufacturing method[24]. The voucher specimens were deposited for preservation in the herbarium at Jeonju University (JJU). Scientific names of plants were confirmed with the National Knowledge and Information System for Biological Species (NKISBS) of Korea[27].

Quantitative analysis

The informant consensus factor (ICF) was opted to analyze the degrees of agreement among the informants on the traditional plant-based application of pain ailments[17, 28, 29, 30]. It was calculated by the following formula: $ICF=n_{ur}–n_t/n_{ur}–1$ (n_{ur} is the number of use-reports for each of the 23 pain ailments; n_t is the number of plant species used).

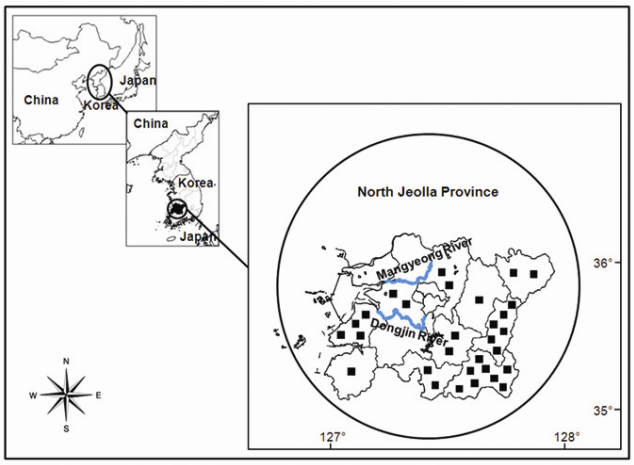

Fig. 1—Thirty study areas for investigation

The fidelity level (FL) was employed to determine the most important plant species used in traditional plant-based applications of specific pain ailments by the local herbal practitioners or elders living in the study area[17, 31]. It was calculated by the following formula: $FL(\%)=N_p\times100/N$ (N_p is the number of informants to mention plant species for treating one particular pain ailments; N is the total number of informants who used medicinal plants for any given ailments).

Results and discussion

Ethnomedicinal analysis

The informants participating in investigation on 32 sites is the total 71 people (29 men and 42 women) and the recorded traditional treatment knowledge is 1,071. Among them, 313 traditional plant-based applications to 23 ailments of pain relief were recorded from 64 informants (25 men and 39 women) on 30 sites. The average age of the informants was 74 (54-92 years old) arranged in the following age group; in the fifties (8), sixties (12), seventies (28), eighties (15), and nineties (1). Demographics of the interviewees are summarized in Table 1. The traditional treatment knowledge was not nearly recorded from inhabitants less than 50 years of age in the local community. This reason is determined that the young age of the community forgot nearly the tradition treatment knowledge because of the western influence, a rapid urbanization and the industrialization.

Twenty three ailments which were recorded in this study were treated with 313 different modes of plant-based therapeutic application (Tables 2 & 3). The most common ailment is lumbago which 44 informants used 84 traditional plant-based applications occupied 26.8% of the total, followed by melosalgia (50), neuralgia (36), chronic myofascial pain (26) and abdominal pain (20). These ailments compromise about 69% of the total traditional plant-based applications (Fig. 2).

A total of 82 species belonging to 45 families in 74 genera (63 species, 15 varieties and 4 forms) were used as medicinal plants to pain relief. Medicinal plants of 30 species were applied to treat lumbago. Subsequently, 24 species were used for neuralgia, 17 species for melosalgia, 15 species for abdominal pain and so on. Ailments treated by a medicinal plant were pleurodynia, slipped disk, frozen shoulder, hemiplegia and rheumatism (Table 3).

Table 1—Demographic characteristics

Gender	
Male	25 (39 %)
Female	39 (61 %)
Age	
50-59	8 (12.5 %)
60-69	12(18.8 %)
70-79	28 (43.8 %)
80-89	15 (23.4 %)
90-99	1 (1.6 %)
Educational attainment	
Illiterate	46 (72 %)
Attended school for less than 6 years	5 (8 %)
Attended school for 6 years	4 (6 %)
Finished middle school	4 (6 %)
Finished high school	5 (8 %)

Table 2—Representative modes of plant-based therapeutic applications according to 23 ailments

Ailments	Mode of application
Lumbago	Oral application of soup after decocting with root of *Achyranthes japonica*
Melosalgia	Oral application of infusion soup after boiling with stem of *Eleutherococcus sessiliflorus*
Neuralgia	Oral application after brewing rice wine with fruit of *Prunus davidiana*
Chronic myofascial pain	Oral application after making clear soup with dumplings after macerating with root of *Arisaema amurense* for. *serratum*
Abdominal pain	Oral application of leaf juice of *Artemisia princeps*
Arthritis	Oral application of soup after decocting with root of *Cirsium japonicum* var. *maackii*
Sinews and joints pain	Oral application of infusion soup after boiling with root of *Caragana sinica*
Knee pain	Oral application of soup after decocting with root of *Gastrodia elata*
Postpartum myofascial pain syndrome	Oral application of infusion soup after boiling with fruit of *Cucurbita moschata*
Tarsal tunnel syndrome	Oral application of infusion soup after boiling with stem of *Zanthoxylum piperitum*
Chronic myofascial pain of leg	Oral application of soup after decocting with stem of *Eleutherococcus senticosus*
Headache	Oral application after extracting oil by pressing with fruit of *Zanthoxylum schinifolium*
Leg pain	Oral application after brewing rice wine with stem of *Cudrania tricuspidata*
Arthralgia	Oral application after brewing rice wine with fruit of *Sorbus commixta*
Carpal tunnel syndrome	Oral application of soup after decocting with root of *Phytolacca esculenta*
Pleurodynia	Oral application of infusion soup after boiling with leaf and stem of *Taraxacum platycarpum*
Analgesic	Oral application of soup after decocting with root of *Aralia cordata*
Neurasthenia	Oral application after brewing rice wine with fruit of *Rubus coreanus*
Slipped disk	Oral application of soup after decocting with leaf and stem of *Viscum album* var. *coloratum*
Frozen shoulder	Oral application of soup after decocting with leaf and stem of *Dendropanax morbiferus*
Pain	Oral application of soup after decocting with root of *Cnidium officinale*
Hemiplegia	Oral application of soup after decocting with root of *Aralia cordata*
Rheumatism	Oral application of soup after decocting with stem of *Buxus koreana*

Table 3—Information of plant-based therapeutic applications used to treat pain relief

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
Lumbago	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Male (10), female (15)	Root, stem, whole part	Decoction, fermentation, infusion, pill	Oral	27.2
	Campanulaceae	*Adenophora triphylla* var. *japonica* (Regel) H.Hara	*Jandae*	Female (5)	Root	Infusion, simmer	Oral	45.5
	Apiaceae	*Angelica gigas* Nakai	*Chamdanggwi*	Female (3)	Seed	Pill	Oral	100.0
	Araliaceae	*Aralia elata* (Miq.) Seem.	*Dureupnamu*	Male (1), female (2)	Bark	Decoction, fermentation	Oral	27.3
	Araceae	*Arisaema amurense* for. *serratum* (Nakai) Kitag.	*Cheonnamseong*	Male (1)	Corm	Soup	Oral	3.2
	Asteraceae	*Atractylodes ovata* (Thunb.) DC.	*Sapju*	Male (3), female (23)	Stem, root	Decoction, infusion, fermentation, pill	Oral	76.5
	Fabaceae	*Caragana sinica* (Buc'hoz) Rehder	*Goldamcho*	Male (2), female (21)	Root, stem	Decoction, infusion, fermentation	Oral	47.9
	Asteraceae	*Carthamus tinctorius* L.	*Iskkot*	Female (3)	Seed	Pill	Oral	60.0
	Fagaceae	*Castanea crenata* Siebold & Zucc	*Bamnamu*	Female (2)	Fruit	Infusion	Oral	100.0
	Papaveraceae	*Chelidonium majus* var. *asiaticum* (Hara) Ohwi	*Aegittongpul*	Male (1)	Whole part	Fermentation	Oral	10.0
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Male (3), female (3)	Root	Decoction, fermentation, maceration	Oral	19.4
	Campanulaceae	*Codonopsis pilosula* (Franch.) Nannf.	*Mansam*	Female (2)	Root	Decoction	Oral	100.0
	Moraceae	*Cudrania tricuspidata* (Carr.) Bureau ex Lavallee	*Kkujippongnamu*	Male (1), female (2)	Stem	Fermentation, infusion	Oral	75.0
	Asteraceae	*Dendranthema zawadskii* var. *latilobum* (Maxim.) Kitam.	*Gujeolcho*	Male (5), female (5)	Root, stem, whole part	Decoction, infusion, pill	Oral	45.5
	Elaeagnaceae	*Elaeagnus umbellata* Thunb.	*Borisunamu*	Female (3)	Root	Decoction	Oral	100.0
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Male (8), female (11)	Bark, root, stem	Brewing, decoction, fermentation, infusion, pill	Oral	40.4
	Araliaceae	*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.	*Eumnamu*	Male (7), female (25)	Stem	Decoction, fermentation, infusion, simmer	Oral	61.5
	Phytolaccaceae	*Phytolacca esculenta* VanHoutte	*Jarigong*	Female (18)	Root, stem	Fermentation, infusion	Oral	66.7
	Pinaceae	*Pinus densiflora* Siebold & Zucc.	*Sonamu*	Female (8)	Leaf, stem	Decoction, fumigation, poultice	Oral, topical	50.0
	Salicaceae	*Populus maximowiczii* A.Henry	*Hwangcheolnamu*	Female (8)	Stem	Fermentation, infusion	Oral	100.0
	Rosaceae	*Prunus davidiana* (Carriere) Franch.	*Sanboksanamu*	Female (3)	Fruit	Brewing	Oral	27.3
	Ranunculaceae	*Pulsatilla koreana* (Yabe ex Nakai) Nakai ex Mori	*Halmikkot*	Male (1), female (1)	Root	Decoction	Oral	50.0
	Brassicaceae	*Raphanus sativus* L.	*Mu*	Female (3)	Leaf	Poultice	Topical	100.0
	Ericaceae	*Rhododendron mucronulatum* Turcz. var. *mucronulatum*	*Jindalrae*	Male (3), female (22)	Root, stem	Decoction, fermentation, infusion	Oral	78.1
	Polygonaceae	*Rumex crispus* L.	*Sorijaengi*	Male (1), female (2)	Root	Juice	Oral	33.3

(*Contd.*)

Table 3—Information of plant-based therapeutic applications used to treat pain relief – (*Contd.*)

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
	Lamiaceae	*Salvia miltiorrhiza* Bunge	*Dansam*	Female (2)	Root	Decoction	Oral	100.0
	Liliaceae	*Smilax china* L.	*Cheongmiraedeonggul*	Male (1)	Root	Fermentation	Oral	16.7
	Ulmaceae	*Ulmus davidiana* var. *japonica* (Rehder) Nakai	*Neureupnamu*	Male (6), female (6)	Root	Fermentation, maceration, paste	Oral, topical	37.5
	Rutaceae	*Zanthoxylum schinifolium* Siebold & Zucc.	*Sanchonamu*	Male (1)	Stem	Fermentation	Oral	33.3
	Rhamnaceae	*Zizyphus jujuba* var. *inermis* (Bunge) Rehder	*Daechunamu*	Female (2)	Fruit	Infusion	Oral	50.0
Melosalgia	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Male (6), female (12)	Root, stem, whole part	Decoction, fermentation, infusion, pill, simmer	Oral	19.6
	Campanulaceae	*Adenophora triphylla* var. *japonica* (Regel) H.Hara	*Jandae*	Female (2)	Root	Infusion	Oral	18.2
	Lardizabalaceae	*Akebia quinata* (Thunb.) Decne.	*Eureumdeonggul*	Female (2)	Stem	Simmer	Oral	100.0
	Araliaceae	*Aralia elata* (Miq.) Seem.	*Dureupnamu*	Male (1), female (5)	Bark, stem	Fermentation, simmer	Oral	54.5
	Asteraceae	*Artemisia capillaris* Thunb.	*Sacheolssuk*	Female (2)	Whole part	Paste	Topical	40.0
	Asteraceae	*Atractylodes ovata* (Thunb.) DC.	*Sapju*	Male (3), female (5)	Root, stem	Infusion, pill	Oral	23.5
	Fabaceae	*Caragana sinica* (Buc'hoz) Rehder	*Goldamcho*	Male (1), female (2)	Root	Fermentation, infusion	Oral	6.3
	Papaveraceae	*Chelidonium majus* var. *asiaticum* (Hara) Ohwi	*Aegittongpul*	Male (1)	Whole part	Fermentation	Oral	10.0
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Male (4), female (4)	Root	Decoction, fermentation, maceration	Oral	25.8
	Asteraceae	*Dendranthema zawadskii* var. *latilobum* (Maxim.) Kitam.	*Gujeolcho*	Male (5), female (5)	Root, stem, whole part	Decoction, infusion, pill	Oral	45.5
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Male (7), female (9)	Bark, root, stem	Decoction, infusion, pill	Oral	34.0
	Araliaceae	*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.	*Eumnamu*	Male (2), female (2)	Stem	Decoction, fermentation	Oral	7.7
	Ranunculaceae	*Pulsatilla koreana* (Yabe ex Nakai) Nakai ex Mori	*Halmikkot*	Male (1), female (1)	Root	Decoction	Oral	50.0
	Ericaceae	*Rhododendron mucronulatum* Turcz. var. *mucronulatum*	*Jindalrae*	Male (3), female (3)	Root	Decoction, infusion	Oral	18.8
	Rosaceae	*Sanguisorba officinalis* L.	*Oipul*	Female (2)	Root	Infusion	Oral	100.0
	Ulmaceae	*Ulmus davidiana* var. *japonica* (Rehder) Nakai	*Neureupnamu*	Male (6), female (14)	Bark, root, stem	Decoction, fermentation, maceration, paste	Oral, topical	62.5
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Male (1), female (6)	Stem	Decoction, infusion, simmer	Oral	20.7
Neuralgia	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Male (5), female (3)	Root	Decoction, fermentation, infusion	Oral	8.7
	Fabaceae	*Albizia julibrissin* Durazz.	*Jagwinamu*	Male (1)	Root	Decoction	Oral	33.3
	Apiaceae	*Angelica dahurica* (Fisch. ex Hoffm.) Benth. & Hook.f. ex Franch. & Sav.	*Guritdae*	Male (1)	Root	Decoction	Oral	50.0
	Araliaceae	*Aralia cordata* var. *continentalis* (Kitag.) Y.C.Chu	*Dokhwal*	Male (1)	Root	Decoction	Oral	100.0
	Araliaceae	*Aralia elata* (Miq.) Seem.	*Dureupnamu*	Male (1)	Root	Decoction	Oral	9.1

(*Contd.*)

Table 3—Information of plant-based therapeutic applications used to treat pain relief – (*Contd.*)

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
	Buxaceae	*Buxus koreana* Nakai ex Chung & al.	*Hoeyangmok*	Male (1)	Root	Decoction	Oral	50.0
	Fabaceae	*Caragana sinica* (Buc'hoz) Rehder	*Goldamcho*	Male (1), female (3)	Root	Decoction	Oral	8.3
	Papaveraceae	*Chelidonium majus* var. *asiaticum* (Hara) Ohwi	*Aegittongpul*	Male (1)	Root	Decoction	Oral	10.0
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Male (3), female (2)	Root	Decoction, fermentation, infusion	Oral	16.1
	Cornaceae	*Cornus controversa* Hemsl. ex Prain	*Cheungcheungnamu*	Male (1)	Root	Tapping of sap	Oral	100.0
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Male (2)	Root	Brewing	Oral	4.3
	Polygonaceae	*Fallopia multiflora* (Thunb. ex Murray) Haraldson var. *multiflora*	*Hasuo*	Male (1)	Root	Brewing	Oral	50.0
	Oleaceae	*Fraxinus mandshurica* Rupr.	*Deulmenamu*	Male (1)	Root	Infusion	Oral	100.0
	Orchidaceae	*Gastrodia elata* Blume	*Cheonma*	Male (2)	Root	Decoction	Oral	33.3
	Osmundaceae	*Osmunda japonica* Thunb.	*Gobi*	Male (1)	Root	Decoction	Oral	100.0
	Rosaceae	*Prunus davidiana* (Carriere) Franch.	*Sanboksanamu*	Male (3), female (2)	Fruit, stem	Brewing, decoction, extraction	Oral	45.5
	Ericaceae	*Rhododendron mucronulatum* Turcz. var. *mucronulatum*	*Jindalrae*	Male (1)	Root	Decoction	Oral	3.1
	Rosaceae	*Rosa multiflora* Thunb. var. *multiflora*	*Jjilrekkot*	Female (2)	Root	Decoction	Oral	100.0
	Rubiaceae	*Rubia akane* Nakai	*Kkokduseoni*	Male (1)	Root	Infusion	Oral	50.0
	Asteraceae	*Sigesbeckia glabrescens* Makino	*Jindeukchal*	Male (1)	Root	Fermentation	Oral	100.0
	Liliaceae	*Smilax china* L.	*Cheongmiraedeonggul*	Male (1), female (4)	Root	Decoction, infusion	Oral	83.3
	Rosaceae	*Sorbus commixta* Hedl.	*Magamok*	Male (2)	Root	Brewing	Oral	33.3
	Loranthaceae	*Viscum album* var. *coloratum* (Kom.) Ohwi	*Gyeousali*	Male (1)	Root	Decoction	Oral	20.0
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Male (3)	Root	Infusion	Oral	10.3
Chronic myofascial pain	Fabaceae	*Albizia julibrissin* Durazz.	*Jagwinamu*	Male (1), female (1)	Root	Brewing	Oral	66.7
	Araceae	*Arisaema amurense* for. *serratum* (Nakai) Kitag.	*Cheonnamseong*	Male (13), female (16)	Root	Clear soup with dumplings, decoction, maceration	Oral	93.5
	Papaveraceae	*Chelidonium majus* var. *asiaticum* (Hara) Ohwi	*Aegittongpul*	Male (4)	Leaf, stem	Maceration, paste	Topical	40.0
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Male (2), female (2)	Root	Infusion, juice	Oral	12.9
	Asteraceae	*Dendranthema zawadskii* var. *latilobum* (Maxim.) Kitam.	*Gujeolcho*	Female (2)	Root	Decoction	Oral	9.1
	Lamiaceae	*Perilla frutescens* var. *japonica* (Hassk.) Hara	*Deulkkae*	Male (1), female (1)	Seed	Oil	Oral	100.0
	Phytolaccaceae	*Phytolacca esculenta* VanHoutte	*Jarigong*	Female (4)	Root	Clear soup with dumplings, maceration	Oral	14.8

(*Contd.*)

Table 3—Information of plant-based therapeutic applications used to treat pain relief – (*Contd.*)

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
	Pinaceae	*Pinus densiflora* Siebold & Zucc.	*Sonamu*	Male (3), female (3)	Resin	Dissolution, paste	Oral, topical	37.5
	Rubiaceae	*Rubia akane* Nakai	*Kkokduseoni*	Male (1)	Root	Juice	Oral	50.0
	Cucurbitaceae	*Trichosanthes kirilowii* Maxim.	*Haneultari*	Female (28)	Fruit	Brewing, decoction, infusion, maceration, paste	Oral, topical	100.0
	Poaceae	*Triticum aestivum* L.	*Mil*	Male (6), female (8)	Root	Clear soup with dumplings	Oral	100.0
Abdominal pain	Liliaceae	*Allium tuberosum* Rottler ex Spreng.	*Buchu*	Male (1), female (2)	Whole part	Juice, porridge	Oral	100.0
	Asteraceae	*Artemisia capillaris* Thunb.	*Sacheolssuk*	Female (3)	Leaf	Infusion	Oral	60.0
	Asteraceae	*Artemisia princeps* Pamp.	*Ssuk*	Male (2), female (15)	Leaf, stem, whole part	Juice	Oral	100.0
	Ebenaceae	*Diospyros kaki* Thunb.	*Gamnamu*	Female (1)	Fruit	Infusion	Oral	100.0
	Juglandaceae	*Juglans mandshurica* Maxim. var. *mandshurica* for. *mandshurica*	*Garaenamu*	Female (2)	Fruit	Raw	Oral	100.0
	Lamiaceae	*Leonurus japonicus* Houtt.	*Ikmocho*	Female (8)	Leaf, stem, whole part	Juice, maceration	Oral	100.0
	Boraginaceae	*Lithospermum erythrorhizon* Siebold & Zucc.	*Jichi*	Female (1)	Whole part	Infusion	Oral	100.0
	Poaceae	*Oryza sativa* L. var. *sativa*	*Byeo*	Female (2)	Whole part	Porridge	Oral	100.0
	Poaceae	*Panicum miliaceum* L.	*Gijang*	Male (1)	Seed	Boiling	Oral	100.0
	Papaveraceae	*Papaver somniferum* L.	*Yanggwibi*	Female (3)	Leaf	Decoction	Oral	100.0
	Plantaginaceae	*Plantago asiatica* L.	*Jilgyeongi*	Female (2)	Whole part	Decoction	Oral	100.0
	Rosaceae	*Prunus mume* Siebold & Zucc. for. *mume*	*Maesilnamu*	Female (1)	Fruit	Extraction	Oral	100.0
	Anacardiaceae	*Rhus verniciflua* Stokes	*Otnamu*	Male (1), female (1)	Stem	Infusion	Oral	100.0
	Rosaceae	*Sorbus commixta* Hedl.	*Magamok*	Female (1)	Stem	Decoction	Oral	33.3
	Styracaceae	*Styrax japonicus* Siebold & Zucc.	*Ttaejuknamu*	Male (2), female (1)	Fruit	Raw	Oral	100.0
Arthritis	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Male (5), female (4)	Root	Decoction, fermentation, juice	Oral	9.8
	Araliaceae	*Aralia cordata* Thunb.	*Ttangdureup*	Male (1)	Root	Decoction	Oral	33.3
	Araliaceae	*Aralia elata* (Miq.) Seem.	*Dureupnamu*	Male (1)	Bark	Decoction	Oral	9.1
	Araceae	*Arisaema amurense* for. *serratum* (Nakai) Kitag.	*Cheonnamseong*	Male (1)	Corm	Soup	Oral	3.2
	Ranunculaceae	*Caltha palustris* L. var. *palustris*	*Donguinamul*	Male (2)	Leaf	Maceration, paste	Topical	100.0
	Asteraceae	*Carthamus tinctorius* L.	*Iskkot*	Female (2)	Seed	Soup	Oral	40.0
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Male (2), female (2)	Root	Decoction	Oral	12.9
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Male (2)	Root, stem	Brewing	Oral	4.3
	Eucommiaceae	*Eucommia ulmoides* Oliv.	*Duchung*	Male (1)	Bark	Decoction	Oral	100.0
	Orchidaceae	*Gastrodia elata* Blume	*Cheonma*	Male (2)	Root	Decoction	Oral	33.3
	Araliaceae	*Hedera rhombea* (Miq.) Bean	*Songak*	Male (1)	Fruit	Decoction	Oral	100.0

(*Contd.*)

Table 3—Information of plant-based therapeutic applications used to treat pain relief – (*Contd.*)

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
Sinews and joints Pain	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Female (9)	Root	Brewing, infusion, pill	Oral	9.8
	Ranunculaceae	*Aconitum ciliare* DC.	*Nosjeosgaraknamul*	Male (1), female (3)	Root	Decoction, infusion	Oral	28.6
	Fabaceae	*Caragana sinica* (Buc'hoz) Rehder	*Goldamcho*	Female (9)	Root	Brewing, infusion, pill	Oral	18.8
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Male (1), female (1)	Stem	Decoction	Oral	4.3
	Araliaceae	*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.	*Eumnamu*	Female (9)	Root, stem	Brewing, infusion, pill	Oral	17.3
	Polygonaceae	*Rumex crispus* L.	*Sorijaengi*	Male (1), female (2)	Root	Infusion	Oral	33.3
Knee pain	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Male (6), female (7)	Root, whole part	Decoction, Fermentation, infusion, maceration	Oral, topical	14.1
	Fabaceae	*Caragana sinica* (Buc'hoz) Rehder	*Goldamcho*	Male (1)	Root	Fermentation	Oral	2.1
	Papaveraceae	*Chelidonium majus* var. *asiaticum* (Hara) Ohwi	*Aegittongpul*	Female (2)	Whole part	Decoction	Oral	20.0
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Female (2)	Root	Dissolution	Oral	6.5
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Female (3)	Root	Infusion	Oral	6.4
	Orchidaceae	*Gastrodia elata* Blume	*Cheonma*	Female (2)	Root	Decoction	Oral	33.3
	Pinaceae	*Pinus densiflora* Siebold & Zucc.	*Sonamu*	Female (2)	Sprout	Brewing	Oral	12.5
Postpartum myofascial pain syndrome	Campanulaceae	*Adenophora triphylla* var. *japonica* (Regel) H.Hara	*Jandae*	Male (1), female (3)	Root, whole part	Infusion	Oral	36.4
	Papaveraceae	*Chelidonium majus* var. *asiaticum* (Hara) Ohwi	*Aegittongpul*	Male (1)	Whole part	Decoction	Oral	10.0
	Cucurbitaceae	*Cucurbita moschata* Duchesne	*Hobak*	Female (5)	Fruit	Infusion	Oral	100.0
	Poaceae	*Imperata cylindrica* var. *koenigii* (Retz.) Pilg.	*Tti*	Male (1)	Flower	Decoction	Oral	100.0
	Scrophulariaceae	*Paulownia coreana* Uyeki	*Odongnamu*	Female (4)	Inside layer of bark, leaf	Decoction	Oral	100.0
	Polygonaceae	*Rumex crispus* L.	*Sorijaengi*	Male (1), female (2)	Root	Infusion	Oral	33.3
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Female (3)	Stem	Infusion	Oral	10.3
	Rhamnaceae	*Zizyphus jujuba* var. *inermis* (Bunge) Rehder	*Daechunamu*	Male (1), female (1)	Fruit	Infusion	Oral	50.0
Tarsal tunnel syndrome	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Female (1)	Whole part	Decoction	Oral	1.1
	Ranunculaceae	*Aconitum ciliare* DC.	*Notjeotgaraknamul*	Female (5)	Root	Decoction, infusion	Oral	35.7
	Rubiaceae	*Gardenia jasminoides* Ellis	*Chijanamu*	Female (2)	Fruit	Paste	Topical	100.0
	Phytolaccaceae	*Phytolacca esculenta* VanHoutte	*Jarigong*	Female (2)	Root	Decoction	Oral	7.4
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Female (5)	Stem	Infusion	Oral	17.2

(*Contd.*)

Table 3—Information of plant-based therapeutic applications used to treat pain relief – (*Contd.*)

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
Chronic myofascial pain of leg	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Female (4)	Root	Brewing, fermentation	Oral	4.3
	Asteraceae	*Cirsium japonicum* var. *maackii* (Maxim.) Matsum.	*Eonggeongkwi*	Female (2)	Root	Decoction	Oral	6.5
	Araliaceae	*Eleutherococcus senticosus* (Rupr. & Maxim.) Maxim.	*Gasiogalpi*	Female (2)	Stem	Decoction	Oral	100.0
	Araliaceae	*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.	*Eumnamu*	Female (4)	Stem	Decoction	Oral	7.7
	Paeoniaceae	*Paeonia lactiflora* Pall.	*Jakyak*	Male (2)	Root	Decoction	Oral	100.0
Headache	Apiaceae	*Angelica dahurica* (Fisch. ex Hoffm.) Benth. & Hook.f. ex Franch. & Sav.	*Guritdae*	Male (1)	Root	Decoction	Oral	50.0
	Apiaceae	*Angelica tenuissima* Nakai	*Gobon*	Male (1)	Root	Decoction	Oral	100.0
	Malvaceae	*Gossypium indicum* Lam.	*Mokhwa*	Male (1), female (1)	Seed	Roast	Oral	100.0
	Araliaceae	*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.	*Eumnamu*	Female (2)	Stem	Simmer	Oral	3.8
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Male (1), female (1)	Seed	Oil	Oral	6.9
	Rutaceae	*Zanthoxylum schinifolium* Siebold & Zucc.	*Sanchonamu*	Male (1), female (1)	Fruit	Oil	Oral	66.7
Leg pain	Moraceae	*Cudrania tricuspidata* (Carr.) Bureau ex Lavallee	*Kkujippongnamu*	Male (1)	Stem	Brewing	Oral	25.0
	Araliaceae	*Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu	*Ogalpinamu*	Male (1), female (2)	Bark, stem	Brewing, fermentation	Oral	6.4
	Gentianaceae	*Gentiana scabra* Bunge for. *scabra*	*Yongdam*	Male (1)	Root	Infusion	Oral	100.0
	Araliaceae	*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.	*Eumnamu*	Male (1)	Stem	Brewing	Oral	1.9
	Rosaceae	*Prunus davidiana* (Carriere) Franch.	*Sanboksanamu*	Female (3)	Fruit	Brewing	Oral	27.3
Arthralgia	Amaranthaceae	*Achyranthes japonica* (Miq.) Nakai	*Soemureup*	Male (1), female (4)	Root, whole part	Decoction, infusion	Oral	5.4
	Fabaceae	*Caragana sinica* (Buc'hoz) Rehder	*Goldamcho*	Female (8)	Root	Infusion	Oral	16.7
	Rosaceae	*Sorbus commixta* Hedl.	*Magamok*	Male (1)	Fruit	Brewing	Oral	16.7
Carpal tunnel syndrome	Ranunculaceae	*Aconitum ciliare* DC.	*Notjeotgaraknamul*	Female (5)	Root	Decoction, infusion	Oral	35.7
	Phytolaccaceae	*Phytolacca esculenta* VanHoutte	*Jarigong*	Male (1), female (2)	Root	Decoction	Oral	11.1
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Female (5)	Stem	Infusion	Oral	17.2
Pleurodynia	Asteraceae	*Taraxacum platycarpum* Dahlst.	*Mindeulre*	Male (4), female (8)	Leaf, stem	Brewing, infusion	Oral	100.0
Analgesic	Araliaceae	*Aralia cordata* Thunb.	*Ttangdureup*	Male (1)	Root	Decoction	Oral	33.3
	Rutaceae	*Zanthoxylum piperitum* (L.) DC.	*Chopinamu*	Male (1), female (4)	Bark	Decoction, fermentation	Oral	17.2

(*Contd.*)

Table 3—Information of plant-based therapeutic applications used to treat pain relief – (*Contd.*)

Ailments	Family name	Scientific name	Korean name	Informants	Used part	Preparation	Application	FL
Neurasthenia	Polygonaceae	*Fallopia multiflora* (Thunb. ex Murray) Haraldson var. *multiflora*	*Hasuo*	Male (1)	Root	Brewing	Oral	50.0
	Rosaceae	*Rubus coreanus* Miq.	*Bokbunjattalgi*	Male (4), female (3)	Fruit	Brewing	Oral	100.0
Slipped disk	Loranthaceae	*Viscum album* var. *coloratum* (Kom.) Ohwi	*Gyeousali*	Male (4)	Leaf, stem	Decoction	Oral	80.0
Frozen shoulder	Araliaceae	*Dendropanax morbiferus* H.Lev.	*Hwangchilnamu*	Male (2)	Leaf, stem	Decoction	Oral	100.0
Pain	Apiaceae	*Cnidium officinale* Makino	*Cheongung*	Male (1)	Root	Decoction	Oral	100.0
	Rosaceae	*Sorbus commixta* Hedl.	*Magamok*	Male (1)	Stem	Decoction	Oral	16.7
Hemiplegia	Araliaceae	*Aralia cordata* Thunb.	*Ttangdureup*	Male (1)	Root	Decoction	Oral	33.3
Rheumatism	Buxaceae	*Buxus koreana* Nakai ex Chung & al.	*Hoeyangmok*	Male (1)	Stem	Decoction	Oral	50.0

(*Contd.*)

The combination treatments included over 2 medicinal plants are 104 traditional plant-based applications in the 12 ailments. These occupy about 33% of the whole traditional plant-based applications. Ailment having the most combination therapies lumbago (31) followed by melosalgia (22), chronic myofascial pain (21) and sinews and joints pain (10).

Overall, a total of twelve plant-parts were used. Eight plant-parts were used to treat lumbago, followed by arthritis and postpartum myofascial pain syndrome (7), melosalga (5), abdominal pain (4) and chronic myofascial pain and neuralgia (3).

Medicinal plants were prepared in 21 different methods. Among these, decoction, infusion and fermentation occupied 64% of the total. An oral application accounted for 94% of all applications. Other methods of application include 48 kinds of topical (Table 3).

Analysis of consensus and fidelity

The ICF (Informants Consensus Factor) indicated that there was a level of agreement for the treatment of 23 pain ailments. The consensus on the traditional plant-based application for pleurodynia, slipped disk, frozen shoulder and lumbago showed high scores (Table 4). However, there was no agreement for the traditional plant-based application of pain, hemiplegia and rheumatism. These imply that the informants' reliability about traditional plant-based applications is very low[28, 30].

The FL (Fidelity Level) is the index which ranks the priority of the plants mentioned by the informants to treat pain ailments. In this investigation, medicinal plants with 100% fidelity level and above three mentions among informants were 15 species

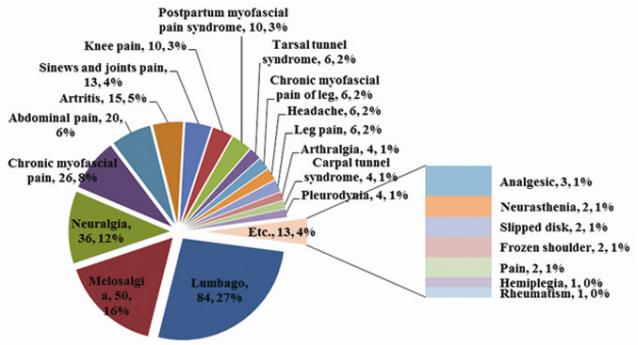

Fig. 2—Number of plant-based therapeutic applications used to treat pain relief

(Table 3). More specifically, abdominal pain was treated with 5 species of medicinal plants with 100% FL, followed by lumbago (4 species); chronic myofascial pain and postpartum myofascial pain syndrome (2 species); pleurodynia and neurasthenia (1 species). These medicinal plants show a very high rate of reliability from the informants[31].

Important medicinal plants

Among three medicinal plants used for appetizer (ICF 0.95), *Dendranthema zawadskii* var. *latilobum* (Maxim.) Kitam had 100% FL index. There is a high possibility that this species will be developed into a new medicine or a new therapy.

For a treatment of detoxification, *Vigna radiata* (L.) Wilcz showed a fidelity level of 100% among 19 informants. Furthermore, *Aconitum ciliare* DC. for treating gastroenteric disorder, *Solanum nigrum* L. var. *nigrum* for indigestion and *Hovenia dulcis* Thunb. ex Murray for liver diseases showed a fidelity rate of 100% among 6 informants. These medicinal plants have the potential to become excellent medicinal material through clinical trials and evaluations.

Table 4—Category of diseases and their informant consensus factors (ICF)

Diseases	Taxons	Use citation	ICF
Pleurodynia	1	12	1.00
Slipped disk	1	4	1.00
Frozen shoulder	1	2	1.00
Lumbago	30	255	0.89
Chronic myofascial pain	11	96	0.89
Melosalgia	17	116	0.86
Sinews and joints pain	6	36	0.86
Arthralgia	3	14	0.85
Carpal tunnel syndrome	3	13	0.83
Neurasthenia	2	7	0.83
Analgesic	2	6	0.80
Knee pain	7	25	0.75
Abdominal pain	15	51	0.72
Tarsal tunnel syndrome	5	15	0.71
Chronic myofascial pain of leg	5	14	0.69
Postpartum myofascial pain syndrome	8	23	0.68
Arthritis	11	26	0.60
Neuralgia	24	52	0.55
Leg pain	5	9	0.50
Headache	6	10	0.44
Pain	2	2	0.00
Hemiplegia	1	1	0.00
Rheumatism	1	1	0.00

Important medicinal plants according to ailments

Taraxacum platycarpum Dahlst. used for pleurodynia had ICF 1.00 and 100% FL index. There is a high possibility that this species will be developed into a new medicine or a new therapy.

Species having high ICF and FL index, *Trichosanthes kirilowii* Maxim. (0.89, 100%) and *Triticum aestivum* L. (0.89, 100%) treated for chronic myofascial pain; *Populus maximowiczii* A.Henry (0.89, 100%) for lumbago; *Artemisia princeps* Pamp. and *Leonurus japonicus* Houtt. (0.72, 100%) for abdominal pain. These medicinal plants have the potential to become excellent medicinal material through clinical trials evaluations.

As species having large consensus of informants and high FL index, *Arisaema amurense* for. *serratum* (Nakai) Kitag. used for treating chronic myofascial pain and *Rhododendron mucronulatum* Turcz. var. *mucronulatum* used for treating lumbago need attention to develop new medicinal materials. Medicinal plants that were used for treating various ailments are as follows; *Achyranthes japonica* (Miq.) Nakai for treating 9 ailments; *Cirsium japonicum* var. *maackii* (Maxim.) Matsum, *Eleutherococcus sessiliflorus* (Rupr. & Maxim.) S.Y.Hu, and *Zanthoxylum piperatum* (L.) DC. for treating 7 ailments; *Caragana sinica* (Buc'hos) Rehder, *Chelidonium majus* var. *asiaticum* (Hara) Ohwi, and *Kalopanax septemlobus* (Thunb. ex Murray) Koidz. for treating 6 ailments. These species need further studies for accurately accessing their medicinal implications.

Conclusion

The significance of orally transmitted traditional plant-based therapeutic application among traditional knowledge will be emphasized to record and conserve, because of its medicinal value. These traditional plant-based therapeutic applications of local community had been using by residents for a long period of times. Therefore, their utility and stability are considerably highly secured.

Particularly, Nagoya protocol[1] provided benefit-sharing of traditional knowledge in indigenous or local community will enhance value for orally transmitted traditional treatment knowledge. In this time, investigation of traditional plant-based therapeutic applications to specific disease is very meaningful. This study will be the model for benefit-sharing of local community, investigator and user of traditional knowledge.

The findings of this study warrant follow-up clinical research to determine the most effective traditional remedies towards development of herbal medicinal products for integration into the Korean healthcare system. These results will help to prepare the way for advanced research such as new medicines and new therapies that could be of help clinically.

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