

**REVIEW ARTICLE****A Systematic Review of Medicinal Plants Used for the Treatment of Headache in Ethiopia**Dasalegn Raga<sup>1\*</sup>, Dereje Denu<sup>1</sup><sup>1</sup>Department of Biology, College of Natural Sciences, Jimma University, Ethiopia\*Corresponding author: [desalegnraga@yahoo.com](mailto:desalegnraga@yahoo.com)**ABSTRACT**

Headache is common neurological disorders and universal human experience in the general population. A web-based research article search strategy related to medicinal plants used for traditional headache treatment in Ethiopia was used to gather literature on traditional headache treatment and systematically reviewed and analyzed. Accordingly, data were collected from a total of 74 Ethiopian studies including published and unpublished (open access local university web sites were used) based on the predetermined criteria. Descriptive statistics, frequency, percentage, tables, and bar graphs were used to summarize relevant ethnobotanical information. A total of 127 different plant species (56 families) were used for headache treatment in different parts of Ethiopia. Variability of medicinal plants used for headache treatment was indicated across different geographic area. Most plant species (38.6 %) used for headache treatment were reported from the western and southwestern parts of the country. Leaves (51.2%) were the most commonly used plant parts followed by roots (23.6%) for remedy preparation in the treatment of headache. Pounding, powdering, concoction, and eating/chewing were the most frequently stated herbal remedy preparation methods. Notably, herbal remedies used for the treatment of headache are administered orally. Studies on medicinal plants used for the treatment of headache in Ethiopia were intended for documentation of the indigenous practice and serve as baseline information for future pharmacological studies. Therefore, it is imperative to do more detail and comprehensive ethnobotanical studies to promote the use of traditional herbal remedies and discover alternative drugs for the treatment of headaches and other ailments.

**Keywords:** Ethnobotany; headache; medicinal plant; remedy; traditional; treatment**INTRODUCTION**

Traditional medicines had been used to treat various health problems in many parts of the world and are still utilized by the developing countries. In Ethiopia, plants have been used as a source of traditional medicine from antiquity to solve different health problems and human sufferings (Deribe, *et al.*, 2006). Like any other developing and less developed nations of the world, the available modern health care services of Ethiopia are not only insufficient but also inaccessible and unaffordable to the majority (Yineger *et al.*, 2008). Thus, medicinal plants continue to be in high demand in the health care system as compared to the modern medicine.

Headache is one of the most common neurological disorders (Andlin-Sobocki *et al.*, 2005) and accounts for multiple visits to the general physician and neurologist and an almost universal human experience in the general population. The global reported percentage of headache

prevalence is 47% and it is the fifth most common primary complaint of patients in the USA (Swadron, 2010). Various forms of headache, properly called headache disorders, are among the most common disorders of the nervous system. They are pandemic and, in many cases, life-long conditions (WHO, 2004). The potential challenge to the neurologist is the effective treatment of headache, and the approach to its management reflects cultural diversity.

Knowledge of traditional medicine has been transferred orally from generation to generation (Giday *et al.*, 2009). Appropriate documentation of traditional medicine constitutes an important task in preserving indigenous knowledge and enhancing community access to and in the improvement of interventions in the control of headache problems. The review was aimed to investigate the plant-based treatments being utilized by Ethiopian traditional healers for headache treatment and compile ethnomedicinal research findings to identify candidate plant species for potential development of therapeutic drugs applicable in headache treatment.

## **MATERIALS AND METHODS**

The review was conducted from June 2019 to July 2020. Systematically, a web-based research article search strategy was employed. Ethnobotanical studies reporting on medicinal plants used for traditional headache treatment in Ethiopia were gathered by different search mechanisms: 1) Search for published journal articles using international scientific databases such as Google scholar, AJOL, Pub Med, Science Direct, Web of Science; 2) Search for unpublished MSc/PhD Thesis/Dissertation using local university websites, Researchgate, and Google search engine. Different keywords/phrases were used for the search of research articles such as: Ethnobotanical study of plants, medicinal plants on headache, Indigenous knowledge, Ethiopian herbal remedies, medicinal plants, headache treatment and headache problems. This approach allowed extracting several journal articles, proceedings, and books from different electronic databases written by several authors.

### **Selection criteria of the research article**

The selection of search output was conducted by using two mechanisms: First, identification of journal articles/theses titles and abstracts were overviewed. Thereafter, appropriate articles/theses were downloaded and seriously scrutinized for inclusion.

### **Inclusion criteria**

Published and unpublished ethnobotanical reports on the treatment of headache and headache related problems in Ethiopia were included. The inclusion was restricted to original research articles conducted in Ethiopia and published in the English language. If the information is not clearly stated or missed, then correction was made, specifically on route of applications, conditions of plant preparation, and misspelled scientific names of the plants.

### **Exclusion criteria**

Published and unpublished ethnobotanical and ethnomedicinal reports lacking information on anyone of the following were excluded: (1) study areas/localities, (2) scientific names of the plants, (3) method of preparation, (4) lack of information on headache treatment; (5) Non-open access journal articles or partially accessed (abstract only).

### **Data retrieval**

An ethnobotanical research study conducted in Ethiopia and providing information on traditional headache curing medicinal plants were collected and entered into Excel spreadsheet format directly and summarized. The correction was made to prevent confusion on different terminologies specifically on preparation methods of the remedy: bathing/evaporating (boiling the materials and taking the vapor or steam through the whole body); pounding (grinding, pulverizing, chopping or crushing of ingredients); concoction (mixing/combining different ingredients to make a dish); decoction (boiling the materials and extracting essences or active ingredients); infusion (macerating/soaking the materials in a liquid or water); smoking (burning dry materials and inhaling the smoke).

**Data analysis**

Descriptive statistical methods, percentage, and frequency were used to analyze ethnobotanical data on reported medicinal plants and associated indigenous knowledge. The spreadsheet data was used to determine frequencies and percentage of citations to identify the most common use, parts used and route of administration and habit of medicinal plants preferred for treatment of headache problems in areas where the researches have been done in the country. The results were presented using pie charts, bar graph and tables.

**Geographical distribution**

The location data (latitude, longitude) for each medicinal plant were collected from the published articles and theses/dissertations on the medicinal plants. The locations (collected in different formats) were converted to decimal degree using excel spreadsheet and were saved in "Text tab delimited" file format. The location data saved in "Text tab delimited" format were imported into QGIS version 3.14 for windows.

**RESULTS AND DISCUSSION****Plant species used for headache treatment**

In this review, 127 plant species belonging to 56 families and 104 genera were identified (Tables 1 and 2). All are used for relieving headache problem in Ethiopia (Table 2). The plant family with the highest number of medicinal plant species used for treatment of headache was Asteraceae (composed of 15 species), followed with Lamiaceae (composed of 13 species) while the remaining 29 families were composed of one species each (Table 1). Frequent citations of a particular plant species or family could indicate its degree of importance and potent possession of higher bioactive constituent for headache treatment. It could also be used for prioritizing the plant for the extraction of various plant-based modern drugs in the future.

**Table 1.** List of plant families with the number of species used for headache treatment in Ethiopia

No	Family	Number of Species	No	Family	No. of Species
1	Asteraceae	15	29	Alliaceae	1
2	Lamiaceae	13	30	Anacardiaceae	1
3	Fabaceae	7	31	Araliaceae	1
4	Solanaceae	5	32	Aspleniaceae	1
5	Boraginaceae	4	33	Brassicaceae	1
6	Euphorbiaceae	4	34	Burseraceae	1
7	Myrtaceae	4	35	Campanulaceae	1
8	Ranunculaceae	4	36	Cannabaceae	1
9	Asclepiadaceae	3	37	Capparidaceae	1
10	Cucurbitaceae	3	38	Commelinaceae	1
11	Meliaceae	3	39	Cupressaceae	1
12	Polygonaceae	3	40	Flacourtiaceae	1
13	Acanthaceae	2	41	Iradiaceae	1
14	Aloaceae	2	42	Lythraceae	1
15	Apiaceae	2	43	Melanthaceae	1
16	Apocynaceae	2	44	Menispermaceae	1
17	Balanitaceae	2	45	Musaceae	1
18	Capparaceae	2	46	Myricaceae	1
19	Caryophyllaceae	2	47	Oliniaceae	1
20	Celastraceae	2	48	Papaveraceae	1
21	Malvaceae	2	49	Piperaceae	1
22	Myrsinaceae	2	50	Plumbaginaceae	1
23	Oleaceae	2	51	Rhamnaceae	1
24	Pittosporaceae	2	52	Rutaceae	1
25	Poaceae	2	53	Salvadoraceae	1
26	Rubiaceae	2	54	Sapindaceae	1
27	Verbenaceae	2	55	Tiliaceae	1
28	Polygalaceae	1	56	Urticaceae	1

### Plant habit

The majority of plants used for the treatment of headache in Ethiopia were herbs (40.5%) (Fig. 1; Table 2). This might be due to: 1) abundance in the areas with relatively high amount of rainfall, 2) presence of strong bioactive compounds (phytochemicals like flavonoids and alkaloids in herbs than in trees and shrubs). The availability of herbs and shrubs in Ethiopia covered by this review (Oromia and SNNPR Regional States) have higher average rainfall compared to other regions of Ethiopia. This made the area conducive for the growth of herbs and collection for remedy preparation. Therefore, the trend of using more herbaceous plants could be advantageous as it is easier to cultivate them when they are in short supply as they are annual plants.

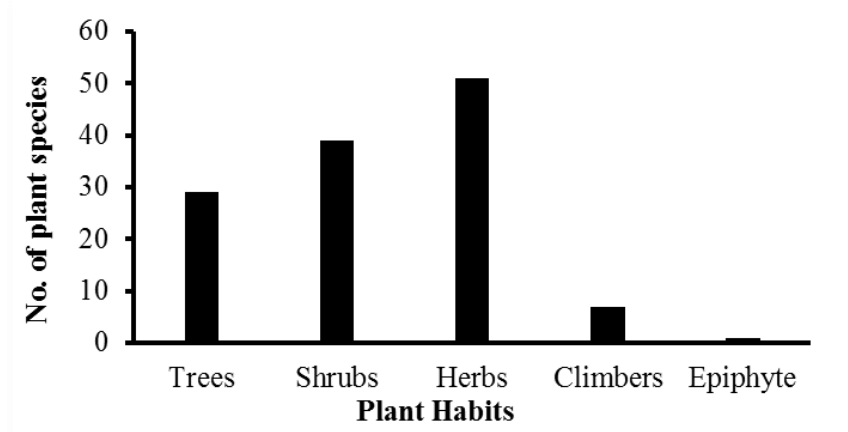
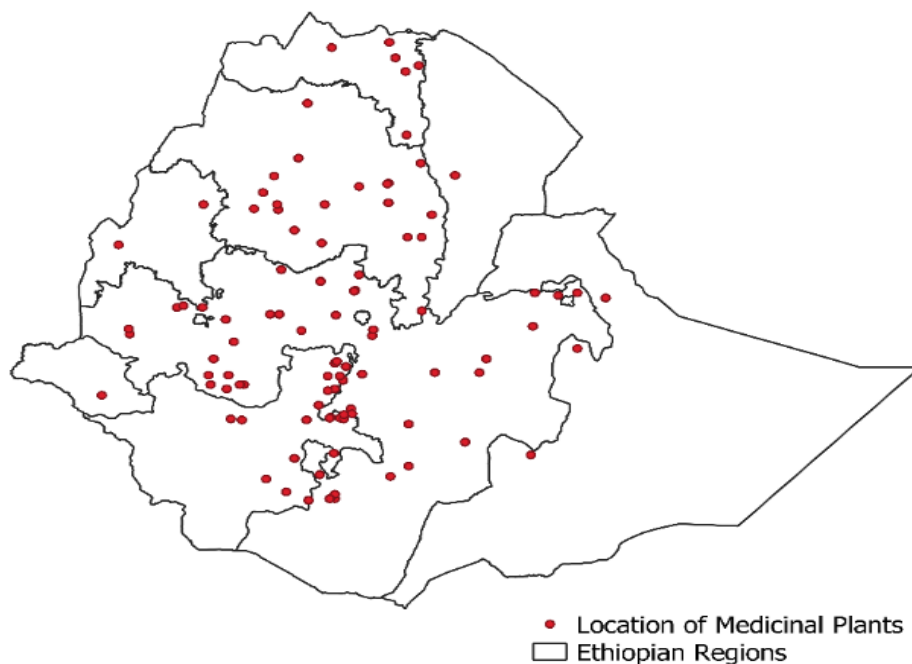


Fig. 1. Plant species with their habits used for treatment of headache in Ethiopia

### Geographic distribution of plants used for headache treatment

The richness and distribution of medicinal plants in different parts of regional states of Ethiopia were reported (Fig. 2; Table 2). Most plant species (83 species, 65%) used for headache treatment were reported from Oromia Regional State followed by South Nations Nationalities and Peoples Region (SNNPR) (33 species, 26%) and 30 species (23%) from the Amhara Regional State. Limited number of plant species being used for headache treatment were also reported from the lowland, hottest and arid region of Afar (Seifu *et al.*, 2006), Gambella region where the temperature is higher (Gebretsadkan, 2017), and Somali Region (Issa *et al.*, 2017). Eventhough the Benishangul Gumuz region is known in having rich floral diversity (Gebeyehu, 2016), the reporting of ethnomedicinal plants for the treatment of headache was very low and none in Harari Regional State. This may show the lack of ethnobotanical research and scientific recording of indigenous knowledge and resource of the region.



**Fig. 2.** Geographical distribution of Medicinal Plants used for traditional treatment of headache across Ethiopia

### **Method of remedy preparation for headache treatment**

Frequent use of pounding might be related to ease of preparation using easily available local materials (Fig. 3). Some of the herbal medicines for headache treatment were prepared from mixtures of two or more different plant species. Some examples reported in this review include: *Ocimum lamiifolium* combined with *Ocimum urticifolium*, *Carissa spinarum*, *Thalictrum rhynochcarpum* (Kebebew, 2017) and *Coffea arabica* (Getaneh and Girma, 2014; Chekole, 2017); *Nigella sativum* with *Brassica juncea* and *Echinops kebericho* (Abara, 2014); *Ruta chalepensis* with *Zingiber officinale*, *Coffea arabica* (Gebrehiwot, 2010) and *Allium sativum* (Wubetu *et al.*, 2017); *Lepidium sativum* with *Ocimum lamiifolium* and *Coffea arabica* (Mesfin *et al.*, 2009); *Maytenus senegalensis* with *Ocimum lamiifolium* and *Coffea arabica* (Mesfin *et al.*, 2009; Bekele and Ramachandra, 2015). Traditional healers use additives to improve the taste and enhance the efficacy and healing conditions of the remedy (Megersa *et al.*, 2013; Alemayehu, 2017). Commonly reported additives include: Coffee, tea, “tella” (local alcoholic drinks), honey and butter (Gebrehiwot, 2010; Abera, 2014; Getaneh and Girma, 2014; Masresha *et al.*, 2015; Chekole, 2017; Tolosa and Megersa, 2018).

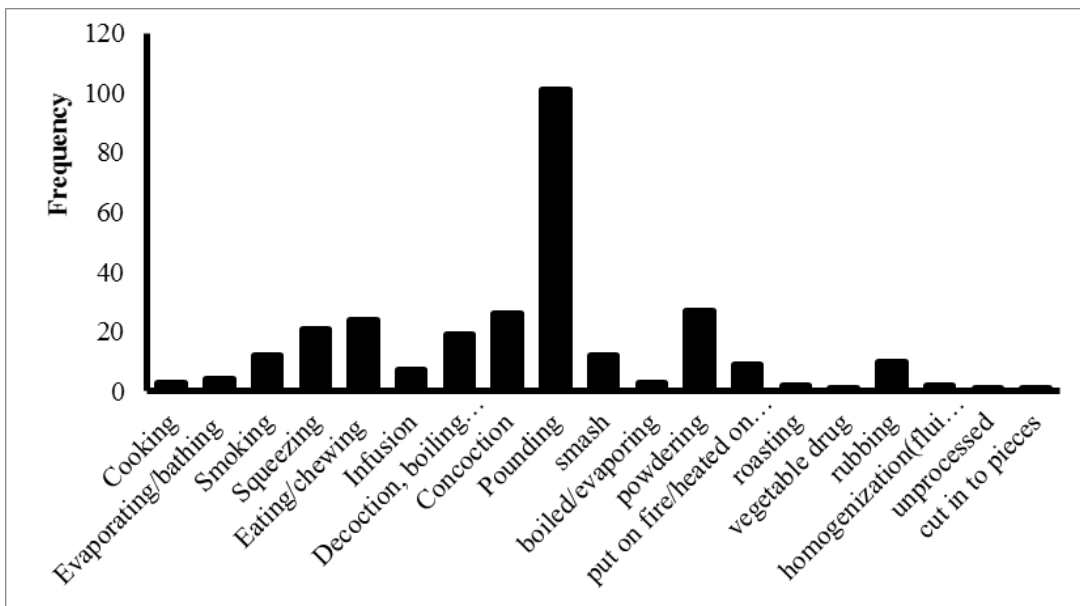
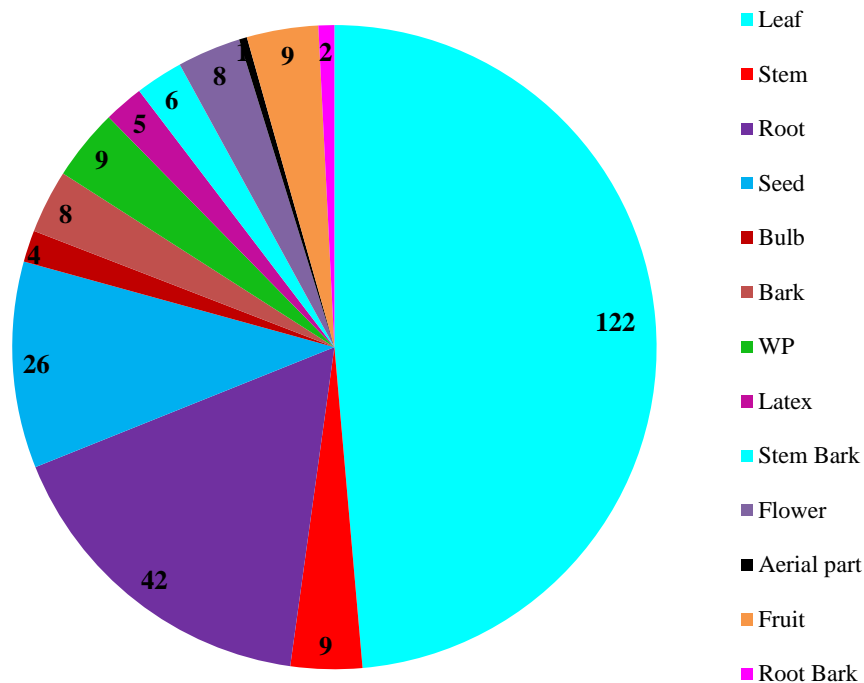


Fig. 3. Methods of remedy preparation for headache treatment in Ethiopia

#### Plant parts used for headache treatment and condition of preparations

Use of diverse plant parts for remedy preparations including leaves, roots, seeds, stems, fruits, whole plant parts, flower, bark, root bark, latex and bulb were reported by various studies (Giday, 2001; Bayih and Usman, 2018; Haile, 2018) (Table 2; Fig. 4). Leaves were the most reported plant parts for remedy preparation for headache treatment (Fig. 4) (Giday, 2001; Amenu, 2007; Tolosa, 2007; Chekole *et al.*, 2015). This might be due to the availability of active chemical entities in leaves which could be extracted in a relatively easy way. Regular harvest of leaves poses low threat to individual plant's survival. Roots are the second most reported plant parts for the treatment of headache. However, frequent usage of roots for herbal preparations can be risky for the survival of the plant species. Thus, the application of proper harvesting mechanisms and conservation measures is necessary to ensure sustainable utilization of medicinal plant resources. Fresh plant parts were the most frequently cited plant conditions for herbal remedies (Mesfin *et al.*, 2014; Chekole *et al.*, 2015; Kefalew *et al.*, 2015; Kebebew, 2017). This is mostly due to the effectiveness of fresh medicinal plants in treatment as the contents are not lost before use compared to the dried forms (Balcha, 2014) and an immediate use without further processing. However, the dependency of the inhabitants on fresh materials put the plants under serious threat than the dried form, as fresh materials are harvested directly and used soon with its extra deterioration with no chance of preservation.



**Fig. 4.** Frequency of plant parts used for herbal preparation in different parts of Ethiopia

#### **Routes of administration**

Herbal remedies for headache treatment were primarily administered through oral, nasal, dermal, and both oral and nasal means (Mesfin *et al.*, 2009; Kebebew and Mohamed, 2017) (Table 2). Oral was the most commonly reported route of administration for headache treatment (Giday, 2001; Teklehaymanot and Giday, 2007; Chekole *et al.*, 2015). Herbal preparations in the form of liquid made from fresh materials were frequently taken orally. Fresh solid materials were also eaten and chewed directly or after initial pounding/crushing. The oral route permits relatively rapid absorption and distribution of active chemical compounds from herbal remedies, enabling the delivery of adequate curative power (Teklay *et al.*, 2013).



**Table 2.** List of all Medicinal plant species used for headache treatment, families, habit, parts used, methods of preparation, and location (Regions) with respective references in Ethiopia

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
1	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	H	L, ST	Sq, Po	O	F	Gebeyehu (2011)	Am
					Po	N	F	Mogosse (2016)	OR
2	<i>Allium sativum</i> L.	Alliaceae	H	BU	Po	O	Dr/F	Mesfin <i>et al.</i> (2014); Giday (2001); Gebriel and Guji (2014)	SN OR
3	<i>Echinops kebericho</i> Mesfin	Asteraceae	H	R	Smo	N	Dr	Mesfin <i>et al.</i> (2014)	SN
					Po	N	Dr	Abara (2014)	OR
					Smo	N	Dr	Nigussie and Kim (2019); Andarge <i>et al.</i> (2015)	SN
					Smo	N	Dr	Kassa <i>et al.</i> (2016)	OR
					Smo	N	F	Teklehaymanot <i>et al.</i> (2006)	Am
4	<i>Myrtus communis</i> L.	Myrtaceae	SH	L	Po, De	O	Dr	Getaneh and Girma (2014)	Am
5	<i>Ocimum lamiifolium</i> Hochst.ex Benth.	Lamiaceae	H	L	Sq	O	F	Getaneh and Girma (2014)	Am
					Sma	N	F	Abara (2014)	OR
					Coc	O	F	Chekole (2017)	Am
					Po	O	Dr	Regasa <i>et al.</i> (2017)	SN
					Po	N	F	Tadesse <i>et al.</i> (2005)	OR
					Sma, Sni	N	F	Amenu (2007)	OR
					Homo Po,Sq, Con	O O	F F	Masresha <i>et al.</i> (2015) Abdurhman (2010)	Am Tig
Sma	N	F	Kebebew (2017)	OR					

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
					Sq	O	F	Meragiaw <i>et al.</i> (2016)	Am
				L	Sma, Sni	N	F	Amde (2016)	Am
				L	Sma, Sni	N	F	Bekele and Ramachandra (2014)	OR
				L	Po, Con	O	F	Gabriel and Guji (2014)	OR
				L,ST	De	O	F	Amde (2016)	OR
				L	Sq	N	F	Issa <i>et al.</i> (2017)	SU
					Sq	O	F	Etana (2010)	OR
					Po	O	F	Tamene (2000)	Am
					Rub, Sq	N	F	Elizabeth <i>et al.</i> (2014)	OR
					Sq	N	F	Yineger <i>et al.</i> (2008)	OR
6	<i>Ocimum urticifolium</i> Roth	Lamiaceae	H	L	Sma	N	F	Amenu (2007)	OR
					Rub	N	F	Tamene (2011)	SN
					Sma	N	F	Kebebew (2017)	OR
				R	Po, Con	O	F	Abara (2014)	OR
				L	Po	N	Dr	Desalegn (2018)	OR
				R	Che	O	F	Bekele and Ramachandra (2014)	OR
7	<i>Carissa spinarum</i> L.	Apocynaceae	SH	L	Po	N	Dr	Amde (2016)	Am
					Po	N	Dr	Amenu (2007)	OR
					Po,Sq,	N	De	Regasa (2016)	OR
8	<i>Nigella sativa</i> L.	Ranunculaceae	H	S	Con, Po	O	Dr	Abara (2014)	OR
				S,F	Cru	N	Dr	Bayih and Usman (2018)	OR
				S	Sni	O	Dr	Ayana (2017)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
				S	Po	N	Dr	Regasa (2013)	SN
				F,S	Che, Pow	O	Dr	Nigussie and Kim (2019)	SN
				FR	Veg.drug	O	F	Abara (2003)	OR
9	<i>Vernonia amygdalina</i> Del.	Asteraceae	SH	L	Po	D	F	Tolosa and Megersa (2018)	OR
					Po	D	F	Bekele and Ramachandra (2014)	OR
					Po	O	F	Masresha <i>et al.</i> (2015)	AM
					Po	O	F	Yineger <i>et al.</i> (2008)	OR
10	<i>Gladiolus schweinfurthii</i> (Baker) Goldblatt & M.P. Devos	Iridaceae	H	R	Po	D	Dr	Tolosa and Megersa (2018)	OR
11	<i>Grewia villosa</i> Willd	Tiliaceae	SH	R	Po	D	Dr	Tolosa and Megersa (2018)	OR
12	<i>Solanum incanum</i> L.	Solanaceae	SH	R	Smo	D	F	Chekole (2017)	Am
					Che	O	F	Bekele and Ramachandra (2014)	OR
13	<i>Commelina foliocea</i> Chiov.	Commelinaceae	H	R	Che	O	F	Yineger <i>et al.</i> (2008)	OR
					Po	D	Dr	Tolosa and Megersa (2018)	OR
14	<i>Clerodendrum myricoides</i> (Hochst.) Vatke	Lamiaceae	SH	R	Po	O	F	Yineger (2005)	OR
					De	O	F	Yineger <i>et al.</i> (2008)	OR
				ST.B	Sme	N	F	Tamene (2011)	SN
				R	Pow	D	Dr	Amde (2016)	Am
				Lat	Pow	D	F/Dr	Desalegn (2018)	OR
15	<i>Cynoglossum amplifolium</i> Hochst. ex A. DC.	Boraginaceae	H	R, L	Che	O	F	Yineger (2005)	OR
16	<i>Helichrysum gofense</i> Cufod.	Asteraceae	H	L	Sma	N	F	Amde (2016)	Am
				L	Con, Po	D	F	Yineger <i>et al.</i> (2008)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
17	<i>Malva verticillata</i> L.	Malvaceae	H	L	Po	D	Dr	Yineger (2005)	OR
18	<i>Maytenus gracilipes</i> (Welw.ex Oliv.) Exell.	Celastraceae	SH	L,ST.B,F	Pow	O	Dr	Yineger (2005)	OR
19	<i>Schefflera volkensii</i> (Engl.) Harms	Araliaceae	T	L	Con, Po	D	F	Yineger (2005)	OR
20	<i>Acacia seyal</i> Del.	Fabaceae	T	R,F	Po,Eva	N	F	Kefalew <i>et al.</i> (2015)	OR
				ST	Hea	N	F	Regassa <i>et al.</i> (2017)	SN
21	<i>Balanites aegyptica</i> (L.) Del.	Balanitaceae	T	ST.B F	Hea Che, De	D Po, O	F F	Regassa <i>et al.</i> (2017) Nigussie and Kim (2019)	SN SN
22	<i>Nicotiana tabacum</i> L.	Solanaceae	H	S	Po	NO	Dr	Regassa <i>et al.</i> (2017)	SN
				L	Po, Pow	N	Dr	Tamene (2011)	SN
					Po, Pow	N	Dr	Kebebew and Mohamed (2017)	SN
23	<i>Croton macrostachyus</i> Del.	Euphorbiaceae	T	L	Sma	N	F	Amenu (2007)	OR
					Po, Sma	Sq, N	F	Regasa (2016)	OR
24	<i>Datura stramonium</i> L.	Solanaceae	H	R	Po	N	F	Amenu (2007)	OR
				Wp	Po	D	F	Wubetu <i>et al.</i> (2017)	Am
				R	Po	N	F	Kebebew (2017)	OR
				F	Boi	N	Dr	Bekele and Ramachandra (2014)	OR
				R	Po	N	F	Amde (2016)	Am
25	<i>Pterolobium stellatum</i> (Forssk.) Brenan	Fabaceae	SH	R	Pow	N	F	Amenu (2007)	OR
26	<i>Musa x paradisiaca</i> L.	Musaceae	H	FR	Che	O	F	Wolditsadik (2018)	OR
					Che	O	F	Beyi (2018)	OR
27	<i>Ruta chalepensis</i> L.	Rutaceae	H	L,FR	Po	O	F	Tadesse <i>et al.</i> (2005)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
				L	Po	O	F	Gebrehiwot (2010)	OR
					Homo	O	F	Masresha <i>et al.</i> (2015)	Am
					Pow Con	O	F	Wubetu <i>et al.</i> (2017)	Am
				L, ST	Po	O	F	Nigussie and Kim (2019)	SN
				L	Sq	O	F	Adibaru (2018)	Am
					De Con	O	F	Gedif and Heinz (2002)	SN
28	<i>Artemisia abyssinica</i> Sch. Bip. ex. A. Rich.	Asteraceae	H	Wp	Po Con	O	F	Haile (2018)	Am
29	<i>Rosmarinus officinalis</i> L.	Lamiaceae	H	R	Pow Pow Con	O	F	Wolditsadik (2018) Kefalew <i>et al.</i> (2015)	OR
					Pow	O	F	Beyi (2018)	OR
30	<i>Pilea tetraphylla</i> (Steudel) Blume	Urticaceae	H	L	Po	N	F	Andarge <i>et al.</i> (2015)	SN
31	<i>Polygala persicariifolia</i> DC.	Polygonaceae	H	R	Pow	N	F	Andarge <i>et al.</i> (2015)	SN
32	<i>Piper capense</i> L.f	Piperaceae	SH	FR	Po	Con	Dr	Andarge <i>et al.</i> (2011)	SN
33	<i>Pluchea ovalis</i> (Pers.) DC.	Asteraceae	T	B	Po	N	F	Amde (2016)	Am
34	<i>Coffea arabica</i> L.	Rubiaceae	SH	S, L	Roa,Po, Boi	O	F/Dr	Ashagre (2017)	OR
				S	Con, Che	O	Dr	Tamene (2011)	SN
					Pow	O	Dr	Masresha (2019)	OR
					Po	N	F/Dr	Kebebew and Mohamed (2017)	SN
					Po	O	Dr	Kassa <i>et al.</i> (2016)	OR
				L/S	Con	O	F	Abara (2003)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
35	<i>Ocimum basilicum</i> L.	Lamiaceae	SH	L	Po	N	Dr	Amde (2016)	Am
36	<i>Ricinus communis</i> L.	Euphorbiaceae	SH	S	Po	N	Dr	Etana (2010)	OR
					Po, Con	D	Dr	Amde (2016)	Am
37	<i>Lepidium sativum</i> L.	Brassicaceae	H	S	Po	D	F	Mogosse (2016)	OR
					Pow	O	Dr	Mesfin <i>et al.</i> (2009)	SN
						O	F	Bekele and Ramachandra (2015)	OR
38	<i>Eucalyptus citriodora</i> Hook.	Myrtaceae	T	L	Rub	N	Dr	Tamene (2011)	SN
39	<i>Flacourtia indica</i> (Burm.f.) Merr.	Flacourtiaceae	SH	Wp	Hea	N	Dr	Tamene (2011)	SN
40	<i>Ocimum jamesii</i> Sebal.	Lamiaceae	SH	L	Rub	O	F	Tamene (2011)	SN
41	<i>Pittosporum abyssinicum</i> Del.	Pittosporaceae	T	ST.B	Smo	N	F	Tamene (2011)	SN
42	<i>Ranunculus multifidus</i> Forssk.	Ranunculaceae	H	L	Rub	N	F	Tamene (2011)	SN
43	<i>Artemisia afra</i> Jack. ex Willd.	Asteraceae	H	L	Che	O	F	Mesfin <i>et al.</i> (2009)	SN
								Bekele and Ramachandra (2015)	OR
44	<i>Maytenus senegalensis</i> (Lam.) Excell.	Celastraceae	SH	S	Pow	O	F/Dr	Mesfin <i>et al.</i> (2009)	SN
					Pow, Con	O	Dr	Bekele and Ramachandra (2014)	OR
					Pow	O	F/Dr	Bekele and Ramachandra (2015)	OR
45	<i>Myrica salicifolia</i> Hochst ex A. Rich.	Myricaceae	T	B	Po	N	Dr	Teklay <i>et al.</i> (2013)	Tig
				R	Pow	N	DR	Wubetu <i>et al.</i> (2017)	Am
				B	Po	N	F	Alemayehu (2017)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
46	<i>Rumex abyssinicus</i> Jacq.	Polygonaceae	H	L/R	Con	O	F	Teklay <i>et al.</i> (2013)	Tig
47	<i>Ehretia cymosa</i> Thonn.	Boraginaceae	T	L	Po Pow	O O	F Dr	Ashagre (2017) Alemayehu <i>et al.</i> (2015)	OR Am
48	<i>Artemisia schimperi</i> Sch.Bip. ex Engl.	Asteraceae	H	Wp	De	D	F/Dr	Gebrehiwot (2010)	OR
49	<i>Echinops angustilobus</i> S.Moore	Asteraceae	H	R	Con	O	Dr	Gebrehiwot (2010)	OR
50	<i>Canarina eminii</i> Aschers ex Schweinf	Campanulaceae	CL	Wp	Po, Che Che	O O	F F/Dr	Bekele and Ramachandra (2015) Megersa <i>et al.</i> (2013)	OR OR
51	<i>Cynoglossum lanceolatum</i> Forssk.	Boraginaceae	H	R,L L	Che Po	O N	F F	Yineger (2005) Megersa <i>et al.</i> (2013)	OR OR
52	<i>Justicia schimperiana</i> (Hochst.ex.Nees) T. Anders.	Acanthaceae	SH	L R	Put De	D O	F F	Megersa <i>et al.</i> (2013) Bekele and Ramachandra (2014)	OR OR
53	<i>Zehneria scabra</i> (Linn.f.) Sond.	Cucurbitaceae	CL	L	Eva Sq	N/O O	F F	Amsalu <i>et al.</i> (2018) Gedif and Heinz (2002)	Am SN
54	<i>Bersama abyssinica</i> Fresen.	Meliantaceae	SH	R,B,ST. B B,S,L	Inf, Pow Po,Che,Sm o	N O	F F	Bekele and Ramachandra (2014) Nigussie and Kim (2019)	OR SN
55	<i>Calpurnia aurea</i> (Ait.) Benth.	Fabaceae	SH	L	Po,Smo Po	N O	Dr F	Bekele and Ramachandra (2014) Tamene (2000)	OR Am
56	<i>Celtis africana</i> Burm.f.	Cannabaceae	T	B	Po	O	Dr	Bekele and Ramachandra (2014)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
57	<i>Clutia abyssinica</i> Jaub.& Spach.	Euphorbiaceae	SH	R	De	O	F	Bekele and Ramachandra (2014)	OR
58	<i>Cordia africana</i> Lam.	Boraginaceae	T	L	De	O	F	Bekele and Ramachandra (2014)	OR
59	<i>Ekebergia capensis</i> Sparrm.	Meliaceae	T	R	De	O	F	Bekele and Ramachandra (2014)	OR
60	<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	H	L	Po	D	F	Bekele and Ramachandra (2014)	OR
61	<i>Leonotis ocymifolia</i> (Burm.f.) Iwarsson	Lamiaceae	SH	L	De	O	F	Bekele and Ramachandra (2014)	OR
					Rub	N	F	Elizabeth <i>et al.</i> (2014)	OR
62	<i>Momordica foetida</i> Schumach.	Cucurbitaceae	CL	L,F	Po	O	F	Bekele and Ramachandra (2014)	OR
63	<i>Ocimum gratissimum</i> L.	Lamiaceae	SH	L	Sma	N	F	Desalegn (2018)	OR
				Wp	De,Inf	O	F	Bekele and Ramachandra (2014)	OR
				L	Po	O	F	Tamene (2000)	Am
64	<i>Vernonia auriculifera</i> Hiern.	Asteraceae	SH	S	Po	N	F	Bekele and Ramachandra (2014)	OR
65	<i>Acalypha</i> sp.	Euphorbiaceae	H	L	Po Con Put	O/N	F	Seifu <i>et al.</i> (2006)	Af
66	<i>Calotropis procera</i> (Ait.) Ait.f.	Asclepiadaceae	SH	R,B	Inf	N	F	Seifu <i>et al.</i> (2006)	Af
67	<i>Kanahia laniflora</i> (Forssk.) R. Br.	Asclepiadaceae	H	L	Inf	N	F/Dr	Seifu <i>et al.</i> (2006)	Af
68	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	T	L	Rub	N	F	Meragiaw <i>et al.</i> (2016)	Am
					Rub,Che,S q	N/O	F	Nigussie and Kim (2019)	SN
				S	Smo	N	F/Dr	Ayana (2017)	OR



S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
				L	Eva	N	F	Gobu (2018)	OR
				L	Rub	N	F	Elizabeth <i>et al.</i> (2014)	OR
69	<i>Abutilon bidentatum</i> (Hochst.) A.Rich.	Malvaceae	H	L	De	O	F	Belayneh and Negussie (2014)	OR
70	<i>Ziziphus spina-christi</i> (L.) Desf.	Rhamnaceae	T	L	Con	D	F	Belayneh and Negussie (2014)	OR
71	<i>Acacia brevispica</i> Harms.	Fabaceae	SH	L	Inf	O	F	Belayneh <i>et al.</i> (2012)	OR
72	<i>Olinia rochetiana</i> A. Juss.	Oliniaceae	T	L	Hea	N	F	Nigussie and Kim (2019)	SN
					Po	O	Dr	Ashagre (2017)	OR
					Hea	N	F	Regasa (2013)	SN
73	<i>Foeniculum vulgare</i> Miller	Apiaceae	H	R	Po,Con	O	F	Ayalew <i>et al.</i> (2016)	OR
74	<i>Clematis simensis</i> Fresen	Ranunculaceae	CL	L	Sq	N	F	Gebeyehu (2016)	B/Gum
					Po	D	F	Desalegn (2018)	OR
75	<i>Justicia ladanoides</i> Lam.	Acanthaceae	H	L	Con, Che	O	F	Gebeyehu (2016)	B/Gum
76	<i>Diplophium africanum</i> Turcz.	Apiaceae	H	L	Unp	N	F	Chekole <i>et al.</i> (2015)	Am
77	<i>Balanites rotundifolia</i> (VanTieghem) Blatter	Balanitaceae	T	ST	Smo	D	DR	Ashagre (2017)	OR
78	<i>Bothriocline schimperi</i> Oliv.& Hiern ex. Benth.	Asteraceae	SH	L	Po,Sq	O	F	Ashagre (2017)	OR
79	<i>Clematis hirsuta</i> Perr. & Guill.	Ranunculaceae	CL	L	Po	N	F	Ashagre (2017)	OR
80	<i>Gardenia ternifolia</i> Schumach. & Thonn.	Rubiaceae	SH	B	Po, Con	O	F	Ashagre (2017)	OR
81	<i>Pappea capensis</i> Eckl.& Zeyh.	Sapindaceae	T	L/B	Po, Con	O	F	Ashagre (2017)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
82	<i>Pseudocedrela kotschyi</i> (Schweinf) Harms	Meliaceae	H	R	Inf	O	F	Gebretsadkan (2017)	Ga
83	<i>Asplenium monanthes</i> L.	Aspleniaceae	EP	L	Po	O	F	Desalegn (2018)	OR
84	<i>Capparis tomentosa</i> Lam.	Capparidaceae	SH	R	Pow	O	F	Desalegn (2018)	OR
				R	Rub	D	F	Tamene (2000)	Am
85	<i>Maesa lanceolata</i> Forssk.	Myrsinaceae	SH	R	Che	O	F	Tolosa (2007)	OR
86	<i>Aloe elegans</i> Tod.	Aloaceae	SH	Lat	Cut	D	F	Beyene (2015)	Tig
87	<i>Aloe macrocarpa</i> Tod.	Aloaceae	SH	Lat	Put	D		Beyene (2015)	Tig
88	<i>Hordeum vulgare</i> L.	Poaceae	H	S	Roa	D	Dr	Beyene (2015)	Tig
89	<i>Solanum schimperiana</i> Hochst.ex.A.Rich	Solanaceae	SH	L	Po	D	F	Beyene (2015)	Tig
90	<i>Vernonia schimperi</i> DC.	Asteraceae	H	B,L,S	Po,Pow,Ch e	O	F	Nigussie and Kim (2019)	SN
91	<i>Vigna sp.</i>	Fabaceae	CL	L,F	Ea,Po,Sq	O	F	Nigussie and Kim (2019)	SN
92	<i>Psidium guajava</i> L.	Myrtaceae	T	FR	Ea	O	F	Nigussie and Kim (2019)	SN
93	<i>Olea welwitschii</i> (Knob./.) Gilg & Schellenb.	Oleaceae	T	L,FR,S	Sq,Che,Po	O	F	Nigussie and Kim (2019)	SN
94	<i>Argemone mexicana</i> L.	Papaveraceae	H	L,FR	Po,Pow,Ch e	O	F	Nigussie and Kim (2019)	SN
95	<i>Boscia angustifolia</i> A. Rich.	Capparaceae	SH	ST	Po	D	F	Tewelde <i>et al.</i> (2017)	Tig
96	<i>Otostegia integrifolia</i> Benth.	Lamiaceae	SH	L	Po,De	O	F	Mogosse (2016)	OR
97	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	SH	R	Pow	N	F	Mogosse (2016)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
98	<i>Silene macrosolen</i> Steud ex. Rich	Caryophyllaceae	H	Wp	Po,Sq	O/N	F	Mogosse (2016)	OR
99	<i>Lippia abyssinica</i> (Otto & Dietr.) Cufod.	Verbenaceae	SH	L	Sq, Con	O	F	Adibaru (2018)	Am
100	<i>Acacia pilispina</i> Pic.Serm.	Fabaceae	T	R	Po	N	Dr	Berhanu (2018)	Am
101	<i>Endostemon tenuiflorus</i> (Benth.) M.Ashby	Lamiaceae	H	Wp	Po	N	F	Baye (2016)	SN
102	<i>Arundinaria alpina</i> K.Scum.	Poaceae	H	B	Po,Sq	N	F	Regasa (2016)	OR
103	<i>Rhus vulgaris</i> Meikle	Anacardiaceae	T	L	Po,Sq	N	F	Regasa (2016)	OR
104	<i>Commiphora hodai</i> Sprague	Burseraceae	H	R	Bur	N	Dr	Issa <i>et al.</i> (2017)	SU
105	<i>Myrsine africana</i> L.	Myrsinaceae	T	L	Po	O	F	Issa <i>et al.</i> (2017)	SU
106	<i>Kleinia sp.</i> Ellis	Asteraceae	H	ST	Che	O	F	Issa <i>et al.</i> (2017)	SU
107	<i>Drymaria cordata</i> (L.) Schultes	Caryophyllaceae	H	L	Put	N	F	Etana (2010)	OR
108	<i>Lawsonia inermis</i> L.	Lythraceae	T	L	Po	D	F	Etana (2010)	OR
109	<i>Mentha spicata</i> L	Lamiaceae	H	L	Po	O	F	Tamene (2000)	Am
110	<i>Olea europaea</i> L. subsp. cuspidata (Wall.ex G.Don) Cif	Oleaceae	T	Lat	Po	N	F	Etana (2010)	OR
111	<i>Plectranthus punctatus</i> (L.f.) L.'Hér	Lamiaceae	H	L	Con	D	F	Etana (2010)	OR
112	<i>Solanecio angulatus</i> (Vahl) C.Jeffrey	Asteraceae	H	L	Cru	N	F	Etana (2010)	OR
113	<i>Pittosporum viridiflorum</i> Sims	Pittosporaceae	T	ST.B	De, Inf	O	F	Bekele and Ramachandra (2014)	OR
114	<i>Boscia senegalensis</i> Lam.ex.Poiret	Capparaceae	SH	R	Po, Pow	O	Dr	Birhanu and Haji (2017)	OR
115	<i>Gomphocarpus integer</i> (N.E.Br.) Bullock	Asclepiadaceae	H	ST.R	Pow	N	Dr	Birhanu and Haji (2017)	OR

S.No	Scientific Name	Families	Hab.	PU	MOP	RA	CP	References	Regions
116	<i>Melia azedarach</i> L.	Meliaceae	T	L	De	O	F	Flatie <i>et al.</i> (2009)	B/Gum
117	<i>Securidaca longepedunculata</i> Fressen.	Polygalaceae	T	R	Po	D	F	Flatie <i>et al.</i> (2009)	B/Gum
118	<i>Trigonella foenum-graecum</i> L.	Fabaceae	H	FR	De	O	F	Abara (2003)	OR
119	<i>Verbena officinalis</i>	Verbenaceae	H	L	De	O	F	Abara (2003)	OR
120	<i>Echinops maracandicus</i> Bunge	Asteraceae	H	R	De	O	F	Gebrehiwot (2018)	Tig
						N	F	Moravec <i>et al.</i> (2014)	Tig
121	<i>Sphaeranthus suaveolens</i> Forssk	Asteraceae	H	L	Po	D	F	Mekonnen and Abebe (2017)	OR
122	<i>Rumex nervosus</i> vahl	Polygonaceae	SH	L	Po, Hom	D	F	Mekonnen and Abebe (2017)	OR
123	<i>Leonotis velutina</i>	Lamiaceae	SH	L	Inf	O	F	Teklehaymanot <i>et al.</i> (2006)	OR
124	<i>Stephania abyssinica</i> (Dillon & A. Rich.)	Menispermaceae	CL	L	Po	D	F	Teklehaymanot and Giday (2007)	Am
125	<i>Carissa spinarum</i> (Forssk.) Vahl.	Apocynaceae	SH	L	Po	O	F	Tamene (2000)	Am
126	<i>Salvadora persica</i> L.	Salvadoraceae	T	L	Po	O	F	Tamene (2000)	Am
127	<i>Juniperus procera</i> Hochst.ex Endl	Cupressaceae	T	L	Put	N	F	Tamrat (2011)	SN

(Key: Af = Afar; Am = Amhara; B = bark; B/Gum = Benishangul Gumuz; Boi = boiled; BU = bulb; Bur = burning; Che = chewed; CL = climber; Coc = cooked; Con = concocted; CP = condition of preparation; Cru = crushed; Cut = cut into pieces; D = dermal; De = decocted; Dr = dry; Ea = eating; EP = epiphyte; Eva = evaporate; F = fresh; Fl = flower; FR = fruit; Ga = Gambela; H = herb; Hab. = Habit; Hea = heated on fire; Homo = homogenization; Inf = infusion; L = leaf; Lat = latex; MOP = method of preparation; N = nasal; O = oral; OR = Oromia; Po = pounded; Pow = powdered; PU = parts used; R = root; RA = route of administration; RB = root bark; Roa = roasted; Rub = rubbed; S = seed; SH = shrub; Sma = smashed; Sme = smelling; Smo = smoked; SN = South Nations Nationalities and Peoples Region; Sni = sniff; Sq = squeezed; ST = stem; ST.B = stem bark; SU = Sumale; T = tree; Tig = Tigray; Unp = unprocessed; Veg.dru = vegetable drug; WP = whole parts)

## CONCLUSIONS

Traditional herbal medicines have historical bases for treatment of headache. This review enabled us to bring the scattered information on medicinal plants used for treatment of headache in Ethiopia into one document. This could help as a baseline for future pharmacological studies. The most frequently cited plant species for headache treatment might be the one with better efficacy and make them a candidate for further scientific studies for their large scale use as an alternative medicine. However, information on the specific type of headache treated, doses of the remedies, methods of preparation, and toxicity were not fully documented by the majority of reviewed ethnobotanical studies. Researchers should focus on plants with therapeutic effects on headache to make them commercially available. Therefore, it is imperative to do more detail and comprehensive ethnobotanical studies to promote the use of traditional herbal remedies and discovery of modern drugs for future treatment of headaches.

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