Review Article

The Use of Medicinal Plants for the Treatment of Toothache in Ethiopia

Moa Megersa, Tilahun Tolossa Jima, and Kabaye Kumela Goro

1Department of Biology, Maddawalabu University, P.O. Box 247, Robe, Ethiopia
2Department of Biology, Ambo University, P.O. Box 19, Ambo, Ethiopia
3Department of Clinical Pharmacy, Jimma University, P.O. Box 378, Jimma, Ethiopia

Correspondence should be addressed to Moa Megersa; moamegersa78@gmail.com

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1. Introduction

1.1. Toothache. Toothache is a common problem occurring in the human population throughout the world frequently. The World Health Organization (WHO) recommended the reduction of toothache as one of the priority issues in the global oral health promotion agenda [1]. Toothache is defined as an orofacial pain originated from a dental element and/or adjacent structures in consequence of several diseases or conditions, such as dental caries, periodontal disease, trauma, occlusal dysfunction, and abscess [2]. The causative factors behind toothache include tooth decay or fracture, abscessed tooth, or infected gums [3]. Over 750 species of bacteria inhabit the oral cavity and a number of these are implicated in oral diseases including toothache [4]. The development of dental caries involves acidogenic and aciduric Gram-positive bacteria, primarily the Streptococcus species, Lactobacillus, and Actinomyces, which metabolize sucrose to organic acids that dissolve the calcium phosphate in teeth [5, 6].

Toothache is prevalent in lower socioeconomic status groups and in populations where dental caries is largely untreated [7–9]. It affects the sleep, feeding, work performance, and productivity [10]; if not treated well can lead to the loss of tooth [3]. In children, the pain can affect school attendance, eating, and speaking and then impair growth and development [11, 12]. The prevalence of dental caries in school-aged children is up to 90% in many parts of the world where the adults are also affected [12]. Epidemiological studies on toothaches conducted elsewhere in Ethiopia indicated that toothache mainly due to dental caries is prevalent in school-aged children. For instance, a study conducted in Finote Selam showed that 48.5% of the students had dental caries [13]. A similar study by Tafere et al. [14] reported that dental caries was 72.8% prevalent among study groups in Debre Tabor, Ethiopia. This indicates the need for improved diagnostic and therapeutic procedures in dentistry, especially in children [15]. However, access to dental healthcare is limited in most developing countries including Ethiopia and is generally restricted to emergency
dental care or pain relief [12]. Thus, visiting dentists is unaffordable and many local communities treat a toothache at home mainly of using plant species as a chewing stick [16].

1.2. Medicinal Plants for Toothache Treatment. Medicinal plants have been used as traditional treatments for numerous human diseases for thousands of years and in many parts of the world [6]. According to the World Health Organization, between 65% and 80% of the populations of developing countries use medicinal plants as remedies [17] and the use of traditional medicine continues to expand rapidly across the world [18]. In Africa, the dependence on traditional medicine is linked with poverty, the inadequacy of health services, and a shortage of drugs [19, 20].

The use of medicinal plants has a long history in dental practice, and they have long been used worldwide [6]. There have been numerous reports of the use of traditional plants and natural products for the treatment of toothaches. For instance, the result of a study in Tanzania indicated that dental patients are commonly treated by traditional healers using medicinal plants [21]. In Cameroon, 32 medicinal plants are used in the treatment of toothache [20]. Local communities in Burkina Faso used 62 medicinal plant species for the treatment of oral diseases, of which 41 plants are utilized for the treatment of toothache alone [22]. In Madagascar, local communities of Mahajanga used 63 plant species to treat dental caries and 23 plants to treat periodontal diseases [23]. A similar study conducted by Ngari et al. [24] and Delfan et al. [25] also showed that local people in Kenya and Lorestan Province of Iran used 12 and 14 medicinal plants, respectively, in order to get relief from toothache.

Like other countries, local communities in Ethiopia use medicinal plants to treat a toothache at a household level to get relief from the disease. Acmella caulirhiza [26, 27], Alhagi sativum [28, 29], Datura stramonium [30], Clausena anisata [28], and Solanum incanum [30] are among the plant species frequently used by local people in Ethiopia, out of which Datura stramonium appeared to be the frequently used plant for toothache treatment.

Herbal extracts have been used in dentistry for reducing inflammation, for inhibiting the growth of oral pathogens, for preventing the release of histamine, and as antiseptics, antioxidants, and analgesics [6, 18]. Various phytochemical studies conducted on medicinal plants traditionally used for toothaches proved the presence of active compounds against oral pathogens. However, many studies investigating the activity of traditional medicinal plants against oral pathogens have been limited to the examination of crude extracts [6, 18]. For example, the methanol extracts of aerial parts of D. stramonium showed the bactericidal activity against Gram-positive bacteria, whereas the ethanol extract exhibited the highest inhibitory against Staphylococcus aureus which is an oral bacterium [31]. A similar study conducted by Balto et al. [32] on the effectiveness of Salvadora persica which is a toothbrush tree traditionally used for oral hygiene in Ethiopia [33] showed an inhibitory effect on oral bacteria. They used ethanol and hexane to extract active compounds from the plant species. Moreover, studies have shown that alcoholic solvents have more antimicrobial activity than aqueous S. persica extracts [32]. In the study of purified phytochemicals against oral pathogens, flavonoids, alkaloids, terpenes, and others showed an inhibitory effect against oral bacteria [6]. For example, tropane alkaloids, atropine, and scopolamine were isolated from D. stramonium [34, 35], two active isoprenylflavones, artocarpin and artocarpesin, were isolated from Artocarpus heterophyllus [36], and phytochemical screening of Clausena anisata revealed the presence of tannins, alkaloids, steroids, saponins, phenolics, and flavonoids [37]. These purified phytochemicals inhibited the growth of numerous oral bacteria responsible for toothache [6].

This review describes the traditional uses of medicinal plants used for toothache treatment in Ethiopia. We also reviewed the experimental evidence that has served to confirm the traditional use of medicinal plants to inhibit the growth of oral pathogens responsible for toothache. Moreover, this review is initiated to identify research gaps and to suggest perspectives for future research in the development of drugs.

2. Methods

The traditional uses of medicinal plants used to treat toothache in Ethiopia were collected from available literature published in scientific journals, books, theses, proceedings, and reports. Literature was searched in PubMed, PMC, Science Direct, and Google Scholar databases and accessed between April 2018 and January 2019 using specific search terms such as “medicinal plants,” “traditional medicines,” and “Ethiopia or Indigenous people”. After identifying potential literature, we searched if there is a report of medicinal plants used for toothache, tooth decay, tooth problems, tooth infection, and tooth pain in the region where the study was carried out. Hence, papers that do not report the use of plant species for toothache treatment were omitted. In addition, studies that reported the use of plant species for brushing purpose were excluded. However, studies that reported the plant species used as brushing for the toothache treatment were included. Data collected from the literature include demography of respondents, year of publication, habit, habitat of the species, preparation methods, plant parts used, and condition. Moreover, a literature search was also conducted to document the biological and pharmacological activities of frequently reported plant species for toothache treatment such as D. stramonium, Olea europaea, A. caulirhiza, and S. incanum. The plant names were directly extracted from the literature and validated using the website (http://www.theplantlist.org).

We reviewed a total of 179 ethnobotanical studies conducted in Ethiopia. A total of 72 studies met the criteria (reporting treatment of anti-toothache/tooth problem using plant species) and were included in the review. The publications reported the use of medicinal plant species to treat toothache in Ethiopia. A list is
produced, showing scientific names, parts used, habit, and references for each species (Table 1).

3. How Many Studies Were Reported on the Use of Medicinal Plants for Toothache Treatment?

A total of 72 ethnobotanical studies performed in Ethiopia that reported the use of medicinal plants for the treatment of toothache were identified (Figure 1). The 72 studies generally reported the use of plant species for human health treatment including toothache. However, no research was conducted specifically on toothache treatment. Of the studies, 27 (37.5%) were carried out in the Oromia region, 18 (25%) in SNNP (South Nation and Nationalities Peoples) region, 15 (21%) in Amhara, and 6 (8.3%) in Tigray region (Figure 2). A review by Alebie et al. [102] on antimalarial plants and Woldeab et al. [103] on antidiarrheal plants in Ethiopia indicated a similar result as many studies were conducted in Amhara, Oromia, and SNNP regions. However, Benishangul, Afar, and Somali regions have received less attention so far; hence, studies should be conducted in these regions as the ethnomedicinal knowledge varies even in the same ethnic group.

The published ethnobotanical studies in Ethiopia are also increasing from year to year. For example, we found one article [39] reporting the use of plants for toothache treatment between 2000 and 2004 and the number increased to 31 between 2015 and 2018 (Figure 2). In agreement, Albuquerque et al. [104] highlighted that ethnobotanical studies are increasing in Brazil which could demonstrate the remarkable growth of ethnobotany as a science.

3.1. Taxonomic Diversity of Medicinal Plants Used for Toothache Treatment in Ethiopia. We report on a total of 130 medicinal plant taxa, belonging to 112 genera and 62 families used by Ethiopian people for the treatment of toothache (Table 2). Among the families that contributed more medicinal species were the Asteraceae, represented by 12 species (9.2%), Fabaceae by 9 (7%) species, and Solanaceae by 5 (4%) species, and other 59 families contributing 104 (80%) species are represented by 1 to 4 species (Table 2). The finding of the family Asteraceae as the contributor of the higher number of plant species used for toothache treatment than other families agrees with a review study conducted on anticancer plants in Ethiopia [105]. A review by Uprety et al. [106] and Kumar [107] also indicated that local communities in the boreal forest of Canada and India prepare remedies for oral health and other disease treatment mainly from Asteraceae family. On the other hand, other researchers reported that Fabaceae is the leading family with the highest number of medicinal plants in various diseases treatment in Ethiopia [102, 103] or elsewhere in the world [108, 109]. Both findings are reasonable since the two families are both represented by a higher number of species in Ethiopian flora [48]. Of the 130 species of medicinal plants reported from the literature, most of them (92, 71%) were obtained from the wild whereas 26 (20%) were from both home gardens and wild habitats, and only 12 (9%) species were from home gardens.

The result of the growth from analysis of medicinal plants used for toothache treatment in Ethiopia showed that shrubs constituted the highest proportion being represented by 45 (34.6%) species, while there were 39 (30%) herb species and 35 (27%) trees (Figure 3). The dominance of shrubs for remedy preparation for toothache treatment is in line with a review by Ålebie et al. [102] and Esubalew et al. [105] on anticancer and antimalarial activity of plant species in Ethiopia. The dominance of shrub for toothache treatment is reasonable as many medicinal plants are being used as a toothbrush. Moreover, it was reported that the availability of shrub plant species throughout the year due to their relative capability of resisting drought and seasonal variation could aid in extensive uses of shrub species compared to herbaceous plants [110].

3.2. Plant Parts Used in Toothache Treatment. Local people of Ethiopia harvest different plant parts for preparation of traditional drugs for toothache treatment (e.g., leaves, roots, seeds, barks, and fruit). In Ethiopia, various authors reported that about 31% of medicinal plants were harvested for their roots and these were followed by leaves (29%) and barks (14%) (Figure 4). The utilization of roots for drug preparation is not a good practice as it threatens the survival of the plant species. Moreover, studies are indicating that over-collection of root parts for remedy preparation poses a threat to medicinal plants as it was observed in many plant species where the roots are utilized [26, 48].

3.3. Condition and Preparation of Traditional Medicine for Toothache Treatment. Most of the remedies (85%) in Ethiopia used for toothache treatment are prepared from fresh parts of medicinal plants followed by dried form 9% and 6% prepared either from dry or fresh plant parts. Most of the medicinal plant’s preparations involved the use of single plant species or a single plant part (97%) while those mixing different plants or plant parts (3%) were rarely reported in the literature.

People living in Ethiopia use different traditional therapeutic methods to get relief from a toothache, which depends on the type of plant species. The plant extract, chewing, concoction, pounding, and decoction are the most common methods to treat the toothache. The most common methods of traditional medicine from plant material was chewing (56.5%), followed by decoction (9.7%), crushing (5.4%), and powdering and others (pounding, holding, rubbing, and inhaling) accounted 3.2% and 47%, respectively.

3.4. The Authors Consensus on Medicinal Plants Used to Treat Toothache in Ethiopia. Of 130 medicinal plants used to treat toothache, all species were not reported equally. Some medicinal plants were reported by various researchers as there are also a single species reported by a single author. For instance, 16 authors reported the use of Datura stramonium
| Family          | Scientific name  | Local name | Growth habit | Part used | Preparation | References |
|----------------|------------------|------------|--------------|-----------|-------------|------------|
| Acanthaceae    | *Barleria homoiotricha* C. B. Clarke | Dhummuga (Or) | Shrub | Barks       | Drink       | [38]       |
|                | *Dyschoriste radicans* (Hochst. ex. Rich.) Nees | Shrimpga (Ti) | Shrub | Twigs       | Chewed      | [40]       |
|                | *Justicia schimperiana* (Hochst. ex Nees) T. Anderson | Q/adii (Or) | Shrub | Bulb        | Crushed     | [28]       |
|                |                   |            |              |            |             |            |
| Alliaceae      | *Allium sativum* L. |            | Herb         |           |             |            |
|                |                   |            |              | Bulb      | Chewed      | [29]       |
|                |                   |            |              | Bulb      | Chewed      | [29]       |
|                |                   |            |              | Bulb      | Chewed      | [41]       |
|                |                   |            |              | Bulb      | Chewed      | [42]       |
| Amaranthaceae  | *Amaranthus caudatus* L. | Hamliadig (Ti) | Herb | Roots       | Chewed      | [29]       |
|                |                   | Chele Shullo (Ke) | Herb | Flowers     | Chewed      | [50]       |
|                |                   |            |              | Flowers   | Chewed      | [50]       |
|                |                   |            |              | Flowers   | Chewed      | [50]       |
|                |                   |            |              | Flowers   | Chewed      | [50]       |
| Anacardiaceae  | *Rhus natalensis* Bernh. ex C. Krauss | Kubri (Ma) | Shrub | Leaves     | Chewed      | [44]       |
|                | *Schinus molle* L. | Q/barbare (Am) | Tree | Stem       | Brushing    | [45]       |
| Apiaceae       | *Foeniculum vulgare* Mill. | Akare (Am) | Herb | Roots      | Decoction   | [46]       |
|                | *Oenanthe palustris* (Chiov.) C. Norman | Itesiel (Am) | Herb | Leaves     | Chewed      | [47]       |
| Apocynaceae    | *Calotropis procera* (Ait.) Dryand. | Agamsa (Or) | Shrub | Barks      | Pounded     | [38]       |
|                | *Carissa spinarum* L. | Shrugga (Or) | Shrub | Barks      | Chewed      | [48]       |
| Araliaceae     | *Schefflera abyssinica* (Hochst. ex A. Rich.) Harms | Arfaasee (Or) | Tree | Barks      | Chewed      | [49]       |
| Asclepiadaceae | *Gomphocarpus purpurascens* A. Rich. | Tseba Dimu (Ti) | Herb | Roots      | Chewed      | [41]       |
| Asparagaceae   | *Asparagus africanus* Lam. | Yst kest (Am) | Shrub | Roots      | Chewed      | [50]       |
|                |                   | Serity (Or) | Shrub | Flowers     | Chewed      | [51]       |
| Asteraceae     | *Acmella caulirhiza* Del. | Etsnegge (Br) | Herb | Root       | Grounded    | [26]       |
|                |                   | Yemidir Berbere (Am) | Stem | Flowers   | Chewed      | [44]       |
|                |                   |            |              | Flowers   | Chewed      | [44]       |
|                |                   |            |              | Flowers   | Chewed      | [44]       |
|                | *Artemisia abyssinica* Sch.Bip. ex A. Rich. | Shrugga (Or) | Herb | Leaves     | Chewed      | [50]       |
|                | *Artemisia afra* Jack. ex Wild. | Kebericho (Am, Or) | Herb | Root       | Powdering   | [45]       |
|                | *Echinops kebericho* Mesfin | Shugra (Am) | Herb | Leaves     | Chewed      | [53]       |
|                | *Echinops macrochaetus* Fresen. | Qore harree (Or) | Herb | Root       | Holding     | [55]       |
|                | *Galinsoya parviflora* Cav. | Midirberber (Am) | Herb | Flower     | Rubbing     | [56]       |
|                | *Inula confertiflora* A. Rich. | Weingarit (Am) | Herb | Leaves     | Chewed      | [57]       |
|                | *Kleinia squarrosa* Cufod. | Luko (Or) | Herb | Stem       | Brushing    | [55]       |
|                | *Laggera intermedia* C. B. Clarke | Himmil (Am) | Herb | Leaves     | Chewed      | [53]       |
|                | *Parthenium hysterophorus* L. | Kalignoole (Or) | Herb | Roots      | Chewed      | [58]       |
|                | *Vernonia amygdalina* Del. | Girava (Am) | Shrub | Leaves     | Chewed      | [51]       |
|                | *Vernonia auriculifera* Hiern | Eebicha (Or) | Shrub | Leaves     | Chewed      | [59]       |
|                |                   |            |              |           |             |            |
| Aquifoliaceae  | *Ilex mitis* (L.) Radlk. | Mi’esa (Or) | Tree | Twigs      | Chewed      | [61]       |
| Balanitaceae   | *Balanites aegyptiaca* (L.) Del. | Badorpsa (Or) | Tree | Barks      | Chewed      | [45]       |
|                |                   | Jemo (Am) | Shrub | Roots      | Pounded     | [62]       |
| Bignoniaceae   | *Stereospermum kunthianum* Cham. | Botoror (Or) | Tree | Stem       | Chewed      | [47]       |
| Boraginaceae   | *Cordia africana* Lam. | Wadesa (Or) | Tree | Barks      | Chewed      | [45]       |
|                |                   | Wanza (Am) | Tree | Barks      | Powdering   | [63]       |
|                | *Cynoglossum coerulenum* Hochst. ex A. DC. | Shinggig (Am) | Herb | Leaves     | Holding     | [64]       |
|                | *Ehretia cymosa* Thonn. | Ulagaaga (Or) | Shrub | Leaves     | Chewed      | [48]       |
|                |                   | Migue (Af) | Tree | Leaves     | Powdering   | [50]       |
|                |                   | Game (Am) | Shrub | Leaves     | Powdering   | [50]       |
|                |                   | Checho (Am) | Leaves |          | Holding     | [65]       |
| Brassicaceae   | *Lepidium sativum* L. | Shinfa (Or) | Herb | Seeds      | Chewed      | [66]       |
| Burseraceae    | *Commiphora hodai* Sprague | Hodai (So) | Herb | Roots      | Inhaling    | [67]       |
| Family             | Scientific name                     | Local name          | Growth habit | Part used | Preparation | References |
|--------------------|-------------------------------------|---------------------|--------------|-----------|-------------|------------|
| Capparaceae        | *Boscia salicifolia* Oliv.          | Awo (Tí)            | Tree         | Leaves    | Chewed      | [41]       |
|                    | *Capparis tomentosa* Lam.           | Hragama (Or)        | Climber      | Roots     | Chewed      | [40]       |
|                    |                                     | Goraa (Or)          |              | Barks     | Crushed     | [49]       |
|                    |                                     |                     |              | Barks     | Chewed      | [68]       |
|                    | *Capparis fascicularis* DC.         | Hida sare (Or)      | Climber      | Leaves    | Heated      | [59]       |
|                    |                                     | Hargama (Or)        |              |          |             |            |
| Capparidaceae      | *Cadaba rotundifolia* Forrsk.       | Qollaadii (Or)      | Tree         | Leaves    | Chewed      | [70]       |
|                    | *Crateva adansonii* DC.             |                     | Shrub        | Leaves    | Heating     | [59]       |
| Caryophyllaceae    | *Drymara cordata* (L.) Schultes     | Hakeato (Ke)        | Epiphyte     |          |             |            |
|                    | *Chenopodium opulifolium* Koch      | Sinin (Am)          | Herb         |          |             |            |
|                    | *Goraa (Or)                         |                     |              |          |             |            |
|                    |                                     |                     |              |          |             |            |
|                    | *Clusia lanceolata* Cambess.        | Ulee foonii (Or)    | Tree         | Leaves    | Chewed      | [71]       |
|                    | *Garcinia livingstonei* T. Anderson| Abuqurto (Or)       | Shrub        | Stem      | Chewed      | [72]       |
| Clusiaceae         | *Gloriosa superba* L.               | Harmel (Or)         | Shrub        | Leaves    | Chewed      | [55]       |
|                    |                                     |                     |              |          |             |            |
|                    |                                     |                     |              |          |             |            |
|                    | *Kalanchoe lacinata* (L.) DC        | Endawula (Am)       | Herb         | Roots     | Chewed      | [50]       |
|                    |                                     |                     |              | Roots     | Chewed      | [57]       |
|                    |                                     |                     |              |          |             |            |
|                    | *Juniperus procera* Hochst. ex Endl.| Gaattiraa (Or)     | Tree         | Bark      | Holding     | [30]       |
|                    |                                     |                     |              |          |             |            |
|                    |                                     |                     |              |          |             |            |
|                    |                                     |                     |              |          |             |            |
|                    | *Momordica foetida* Schumach.       | Umbrao (Ke)         | Climber      |          |             | [43]       |
|                    |                                     |                     |              |          |             |            |
|                    | *Eucalyptus divinorum* Hiern        | Gunna (Ha)          | Shrub        | Roots     | Drink       | [73]       |
|                    |                                     |                     |              | Roots     | Chewed      | [29]       |
|                    |                                     |                     |              | Roots     | Chewed      | [41]       |
|                    |                                     |                     |              |          |             |            |
|                    | *Eucalyptus racemosa* L.            | Keleaw (Tí)         | Shrub        | Roots     | Chewed      | [50]       |
|                    |                                     | Kliaaw (Am)         |              | Roots     | Chewed      | [76]       |
|                    |                                     |                     |              |          |             |            |
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|                    |                                     |                     |              |          |             |            |
|                    | *Clutia abyssinica* Jaub. & Spach   | Ule foní (Or)       | Shrub        | Leaves    | Holding     | [30]       |
|                    |                                     |                     |              | Leaves    | Holding     | [48]       |
|                    | *Phyllanthus sepialis* Mull. Arg    | Binjile (Si)        | Herb         | Roots     | Chewed      | [74]       |
|                    |                                     | Suamiler (Or)       |              | Roots     | Chewed      | [75]       |
|                    |                                     |                     |              |          |             |            |
|                    | *Ricinus communis* L.               | Guloo (Am)          | Shrub        | Roots     | Chewed      | [50]       |
|                    |                                     |                     |              | Roots     | Chewed      | [76]       |
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|                    | *Acacia nilotica* (L.) Willd. ex Del.| Serkema (Or)       | Stem         | Decoction | Chewed      | [69]       |
|                    |                                     | Kesel-e (Af)        |              | Leaves    | Chewed      | [77]       |
|                    |                                     | Garmoya (Af)        |              | Barks     | Chewed      | [77]       |
|                    | *Acacia oerfota* (Forssk.) Schweinf.| Ajo (Or)            | Shrub        | Twigs     | Chewed      | [40]       |
|                    |                                     |                      |              |          |             |            |
|                    | *Albizia gummosifera* (J. F. Gmel.) C.A. Sm. | Muka arbaa (Or) | Tree       | Leaves    | Rubbed      | [48]       |
|                    | *Calpurnia aurea* (Ait.) Benth.     | Digita (Am)         | Shrub        | Roots     | Tied        | [52]       |
|                    |                                     | Cadhiw (Ko)         |              | Roots     | Chewed      | [78]       |
|                    |                                     |                      |              |          |             |            |
| Fabaceae           |                                     |                      |              |          |             |            |
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|                    |                                     |                      |              |          |             |            |
|                    | *Colutea abyssinica* Kunth & Bouche | Taeetaa (Ti)        | Shrub        | Roots     | Chewed      | [41]       |
|                    |                                     |                      |              | Stem      | Heating     | [53]       |
|                    | *Entada abyssinica* A. Rich.        | Galchacha (Si)       | Shrub        | Barks     | Chewed      | [79]       |
|                    | *Erythrina brucei* Schweinf.        | Waleeana (Or)       | Tree         | Barks     | Chewed      | [68]       |
|                    | *Indigofera spicata* Forrsk.        | Gimaly (Me)         | Herb         | Roots     | Chewed      | [60]       |
|                    | *Millettia ferruginea* (Hochst.) Baker | Dhoquonu (Or)      | Tree         | Barks     | Chewed      | [80]       |
|                    |                                     | Yago (Ke)           |              | Seeds     | Chewed      | [43]       |
|                    |                                     |                     |              |          |             |            |
| Placouriaceae      | *Dovyalis abyssinica* (A. Rich.) Warb. | Koshim (Am)        | Tree         | Seeds     | Rubbing     | [81]       |
|                    |                                     |                      |              | Seeds     | Chewed      | [66]       |
| Geraniaceae        | *Geranium sp.*                      | Bedinecho (Da)      | Herb         | Leaves    | Rubbing     | [82]       |
|                    | *Monsonia parvispila* Schinz        |                      |              | Leaves    | Heated      | [56]       |
| Family      | Scientific name                        | Local name       | Growth habit | Part used | Preparation | References |
|-------------|----------------------------------------|------------------|--------------|-----------|-------------|------------|
| Lamiaceae   | Clerodendrum myricoides (Hochst.) R. Br. ex Vatke | Misrich (Am)    | Herb         | Roots     | Crushed     | [45]       |
|             | Isodon ramosissimus (Hook.f.) Codd    | Dingermiko (Ke)  | Herb         | Leaves    | Chewed      | [43]       |
|             | Mentha pulegium L.                    | Setisemhal (Ti)  | Herb         | Leaves    | Chewed      | [29]       |
|             | Ocimum urticifolium Roth              | Eyafa (Sk)       | Herb         | Leaves    | Chewed      | [85]       |
|             | Thymus schimperi Ronniger             | Tesne (Ti)       | Herb         | Whole     | Chewed      | [41]       |
| Loranthaceae| Plicosepalus robustus Wiens & Polhill | Maxxannee (Or)   | Herb         | Roots     | Decoction   | [86]       |
|             | Tapinanthus globiferus (A. Rich.) Tieg. | Shrub Leaves    | Leaves       | Pounded   |             | [38]       |
| Malvaceae   | Pavonia urens Cav.                    | Chfrig (Am)      | Herb         | Roots     | Brushing    | [46]       |
|             | Sida tenuscarpa Vollesen              |                  | Shrub        | Leaves    | Chewed      | [46]       |
| Meliaceae   | Azadirachta indica A. Juss.           | Talaal (So)      | Tree         | Leaves    | Chewed      | [67]       |
|             | Melia azedarach L.                    | Niimi (Or)       | Tree         | Stem      | Chewed      | [30]       |
|             |                                       | Stem Brushing    |              |           |             |            |
| Menispermaceae | Stephania abyssinica (Quart. Dill. & A. Rich.) Walp. | Shinet (Am)     | Climber      | Roots     | Powdered    | [83]       |
| Moraceae    | Ficus palmata Forssk.                 | Beles (Am)       | Tree         | Roots     | Chewed      | [51]       |
|             | Ficus sur Forssk.                     | Shola (Am)       | Tree         | Barks     | Holding     | [46]       |
| Myrtaceae   | Eucalyptus sp.                        | Baxarsaf (So)    | Tree         | Roots     | Rubbing     | [58]       |
| Oleaceae    | Ximenia americana L.                  | Shinet (Am)      | Shrub        | Leaves    | Chewed      | [58]       |
|             |                                       |                  |              |           |             |            |
| Oleaceae    | Olea europaea L.                      | Awlie (Ti)       | Tree         | Stem      | Chewed      | [41]       |
|             |                                       | Wa’era (Ha)      | Tree         | Leaves    | Chewed      | [73]       |
|             |                                       | Ejersa (Or)      | Leaves       | Chewed    |             | [45]       |
|             |                                       | Ejerssa (Si)     | Leaves       | Chewed    |             | [45]       |
|             |                                       |                  |              |           |             |            |
| Oliniaceae  | Olinia rochetiana A. Juss.            | Dalecho (Or)     | Tree         | Leaves    | Holding     | [28]       |
|             |                                       | Chife (Am)       | Tree         | Leaves    | Chewed      | [81]       |
|             |                                       | Nolee (Si)       | Tree         | Barks     | Chewed      | [79]       |
|             |                                       |                  |              | Leaves    | Chewed      | [59]       |
| Opiliaceae  | Ziziphus mauritiana Lam.              | Kasil (So)       | Shrub        | Stem      | Heated      | [57]       |
| Orobanchaceae | Orobanche ramosa L.                  | Yemako (Si)      | Hero         | Roots     | Chewed      | [74]       |
| Oxalidaceae | Oxalis corniculata L.                 | Kakeato (Ke)     | Herb         | Leaves    | Chewed      | [43]       |
|             | Oxalis radioides A. Rich.             | Solcarindo (Ma)  | Herb         | Leaves    | Chewed      | [44]       |
| Phytolaccaceae | Phytolacca dodecandra L’Her.         | Endom (Am)       | Shrub        | Stem      | Chewed      | [51]       |
| Polygalaceae | Securidaca longipedunculata Fresen.   | Etsemena (Am)    | Tree         | Leaves    | Chewed      | [47]       |
| Polygonaceae | Rumex abyssinicus Jacq.               | Mequmeqo (Ti)    | Herb         | Roots     | Chewed      | [41]       |
|             | Rumex nepalensis Spreng.              | Dhangaggo (Or)   | Herb         | Roots     | Chewed      | [89]       |
| Polypodiacae | Drynaria volkensii Hieron.            | Afarthattu (Or)  | Epiphyte     | Roots     | Rhizome     | [48]       |
|             |                                       | Kokosso (Si)     |              |           |             | [90]       |
| Proteaceae  | Faurea speciosa Welw.                 | Gero (Ma)        | Hero         | Roots     | Chewed      | [44]       |
| Ranunculaceae | Clematis longicauda Steud. ex A. Rich. | Zina charo (Sk) | Climber      | Leaves    | Chewed      | [85]       |
|             | Clematis simensis Fresen.             | Hida Fiti (Or)   | Climber      | Barks     | Chewed      | [49]       |
|             |                                          | Fide (Si)        |              | Stem      | Chewed      | [91]       |
|             | Ranunculus multifidus Forssk.         | Sheriti (Me)     | Herb         | Roots     | Chewed      | [60]       |
|             |                                          | Hogiyo (Ke)      |              | Roots     | Chewed      | [43]       |
|             | Thalictrum rhynchocarpum Dill. & A. Rich. | Shunawedi (Ke) | Herb         | Roots     | Chewed      | [43]       |
| Family          | Scientific name                                      | Local name   | Growth habit | Part used | Preparation   | References |
|-----------------|------------------------------------------------------|--------------|--------------|-----------|---------------|------------|
| Rosaceae        | *Prunus africana* (Hook.f.) Kalkman                 | Arara (Ha)   | Tree         | Barks     | Chewed        | [92]       |
|                 | *Prunus persica* (L.) Batsch                         | Omo (Re)     | Tree         | Barks     | Holding       | [89]       |
|                 |                                                      | Koki (Or)    | Tree         |           |               | [47]       |
| Rubiaceae       | *Galium boreo-aethiopicum* Puff                     | Mendefgi (Ti)| Herb        | Roots     | Chewed        | [41]       |
|                 | *Gardenia ternifolia* Schumach. & Thonn.            | Gambilo (Am)| Herb        | Roots     | Chewed        | [42]       |
|                 | *Pavetta gardeniifolia* Hochst. ex A. Rich          | Qadiidaa (Or)| Shrub       | Roots     | Pounded       | [68]       |
|                 | *Pentas lanceolata* (Forssk.) Dellers               | Afì deshe (Ar)| Herb     | Roots     | Chewed        | [44]       |
|                 |                                                      | Uluma (Or)   | Shrub        | Roots     | Chewed        | [28]       |
|                 |                                                      | Limich (Am)  | Root         | Stem      | Brush         | [80]       |
|                 |                                                      | Embricho (Ke)| Stem        | Brush     |               | [65]       |
|                 |                                                      |              |              |          |               | [71]       |
|                 |                                                      |              |              |          |               | [43]       |
| Rutaceae        | *Clausena anisata* (Willd.) Hook.f. ex Benth.       | Limich (Am)  | Shrub        | Root      | Chewed        | [28]       |
|                 |                                                      |              | Stem        | Brush     |               | [80]       |
|                 |                                                      | Embricho (Ke)| Leaves      |          |               | [65]       |
|                 |                                                      |              |              |          |               | [71]       |
|                 |                                                      |              |              |          |               | [43]       |
|                 | *Ruta chalepensis* L.                                | Cilaadama (Or)| Herb       | Leaves   | Chewed        | [94]       |
|                 |                                                      |              | Leaves      |          | Chewed        | [95]       |
|                 |                                                      |              |              |          |               |           |
|                 | *Vepris dainelli* (Pichi-Serm.) Kokwaro            | Mengereto (Ke)| Tree       | Barks     |               | [43]       |
|                 | *Zanthoxylum chalybeum* Engl.                       | Ga’ada (Or)  | Shrub       | Barks     | Holding       | [45]       |
| Salvadoraceae   | *Salvadora persica* L.                               | Qomonyo (Or) | Shrub        | Tree      | Chewed        | [80]       |
|                 |                                                      |              |              | Bark      |               | [97]       |
| Sapindaceae     | *Dodonaea angustifolia* L. f.                       | Itacha (Or)  | Shrub        | Roots     | Brushing      | [96]       |
| Scrophulariaceae| *Verbascum sinaticum* Benth.                        | Timake (Ti)  | Shrub        | Roots     | Chewed        | [41]       |
| Simaroubaceae   | *Brucea antidysenterica* J.F.Mill.                  | Qomonyo (Or) | Shrub        | Roots     | Chewed        | [80]       |
|                 |                                                      |              |              | Bark      |               | [97]       |
|                 |                                                      |              |              |          |               |           |
|                 |                                                      |              |              |          |               |           |
|                 |                                                      |              |              |          |               |           |
| Solanaceae      | *Datura stramonium* L.                               | Herb        | Herb         | Fruits    | Inhaling      | [29]       |
|                 |                                                      |              |              | Seeds     | Decoction     | [30]       |
|                 |                                                      |              |              | Seeds     | Inhaling      | [48]       |
|                 |                                                      |              |              | Asangira (Or)| Chewed     | [44]       |
|                 |                                                      |              |              | Atesefarís (Ma)| Bud       | [44]       |
|                 |                                                      |              |              | Astenagir (Am)| Seeds  | [50]       |
|                 |                                                      |              |              | Hìtsawats (Ti)| Seeds  | [41]       |
|                 |                                                      |              |              |          | Seeds        | [53]       |
|                 |                                                      |              |              |          | Seeds        | [45]       |
|                 |                                                      |              |              |          | Seeds        | [50]       |
|                 |                                                      |              |              |          | Seeds        | [49]       |
|                 |                                                      |              |              |          | Leaves       | [83]       |
|                 |                                                      |              |              |          | Chewed       | [60]       |
|                 |                                                      |              |              |          | Leaves       | [76]       |
|                 |                                                      |              |              |          | Decoction    | [55]       |
|                 |                                                      |              |              |          |              |           |
|                 |                                                      |              |              |          |              |           |
|                 |                                                      |              |              |          |              |           |
| Tiliaceae       | *Grewia bicolor* Juss.                               | Deka (Or)    | Shrub        | Stem      | Brushing      | [55]       |
|                 | *Grewia ferruginea* Hochst. ex A. Rich.             | Tsinquayt (Ti)| Tree       | Roots     | Crushed      | [99]       |
for toothache treatment followed by *Olea europaea* reported by nine authors, whereas 5 studies reported the use of *Acmella caulirhiza*, *Capparis tomentosa*, *Clausena anisata*, and *Premna schimperi* for toothache treatment in different parts of Ethiopia. The other six species (*Allium sativum*, *Ehretia cymosa*, *Euclea racemosa*, and *Solanum incanum*) were reported by four authors to be used in Ethiopian folk medicine to get relief from toothache. A review by Woldeab et al. [103] on antidiarrheal plants indicated that *Amaranthus caudatus*, *Calpurnia aurea*, *Coffea arabica*, *Cordia africana*, *Rumex nepalensis*, *Verbena officinalis*, *Verbascum sinaiticum*, *Vernonia amygdalina*, and *Zehneria scabra* are frequently reported plant species. To prioritize phytochemical and pharmacological studies on medicinal plants and to conserve the plants used for toothache treatment, this review could be used as baseline information.

### 3.5. Phytochemical Studies

Due to the increasing resistance of pathogens to conventional antimicrobial drugs, plant compounds are of interest as antiseptics and alternative antimicrobial substances [111]. To fully understand the pharmacological properties of medicinal plants, it is important to study phytochemistry of such plants [112]. Studies indicated that phytochemical insights into several plants that were similarly used in different countries have led to the isolation of novel structures for the manufacture of new drugs [113]. However, such studies are lacking in Ethiopia considering the vast number of plants used in traditional medicine for toothache and other disease treatment [103]. In recent years, phytochemical studies have been carried out to investigate medicinal plants used for toothache treatment.

A phytochemical study by Geyid et al. [113] has highlighted medicinal plants used to treat human diseases in Ethiopia. Among plants studied which showed inhibitory effect on oral pathogens were *Acacia nilotica*, *Albizia gummifera*, *Artemisia abyssinica*, *Clausena anisata*, *Clematis simensis*, *Cordia africana*, *Dovyalis abyssinica*, *Euclea divinorum*, *Jasminum abyssinicum*, *Momordica foetida*, *Pentas lanceolata*, *Stephania abyssinica*, *Verbascum sinalticum*, and *Ximenia americana*. The authors also indicated that the species possess one or more of compounds among alkaloids, cardiac glycosides, polyphenols, tannins, unsaturated sterol, saponins, and glycosides. The phytochemistry of medicinal plants such as *Acmella caulirhiza* [114], *Allium sativum* [115], *Capparis tomentosa* [116], *Azadirachta indica* [117], *Datura stramonium* [34, 118, 119], *Ehretia cymosa* [120], *Euclea racemosa* [116, 119], *Verbascum sinalticum*, *Ximenia americana* and others.

### Table 1: Continued.

| Family            | Scientific name                     | Local name                      | Growth habit | Part used | Preparation | References |
|-------------------|-------------------------------------|---------------------------------|--------------|-----------|-------------|------------|
| Verbenaceae       | *Premna schimperi* Engl.            | Dabase (Or)                     | Shrub        | Chewed    |             | [49]       |
|                   |                                     | Xaxesa (Or)                     | Chewed       |           |             | [83]       |
|                   |                                     | Chcho (Am)                      | Tree         | Chewed    |             | [46]       |
|                   |                                     |                                 |              | Roots     | Chewed      | [98]       |
|                   |                                     |                                 |              | Leaves    | Chewed      | [100]      |
|                   |                                     |                                 |              | Leaves    | Chewed      | [41]       |
|                   |                                     |                                 |              | Leaves    | Chewed      | [42]       |
|                   |                                     |                                 |              | Roots     | Chewed      | [59]       |
| Vitaceae          | *Cissus quadrangularis* L.          | Gaale-abdi (Or)                 | Climber      | Roots     | Chewed      | [40]       |
|                   |                                     | Etse zewye (Ti)                 | Herb         | Whole     | Chewed      | [41]       |
| Zingiberaceae     | *Aframomum corrorima* (Braun) Jansen| Ofiyo (Ke)                      | Herb         | Seeds     |             | [43]       |
|                   |                                     | Zingibel (Ti)                   | Rhizome      | Chewed    |             | [29]       |
|                   |                                     |                                 | Rhizome      | Holding   |             | [101]      |

Or: Afaan Oromo; So: Somali; Ku: Kunama; Ko: Konta; Ti: Tigre; Am: Amharic; Ha: Hadiya; Ma: Maale; Me: Meinit; Sh: Shinasha; Br: Bertha; Be: Bench; Da: Duwaro; G: Gumuz; Si: Sidama; Sk: Shekikicho; Ar: Ar; Af: Afa; Ke: Keficho.

![Figure 1: Number of ethnobotanical studies in Ethiopia that reported the use of medicinal plants for toothache treatment.](image1.png)

![Figure 2: Number of ethnobotanical studies (toothache) in Ethiopia per year.](image2.png)
and Solanum incanum has also been reported. For instance, the major phytochemicals isolated from D. stramonium are tropane alkaloids, atropine, and scopolamine [35]. Different alkaloids from seeds of D. stramonium were reported by Li et al. [126]. Sixty-four tropane alkaloids have been isolated from D. stramonium [119]. These alkaloids include N-trans-feruloyl tryptamine, hyoscyamilactol, scopoletin, umckalin, daturaolone, daturadiol, N-trans-ferulicacyltyramine, cleomiscosin A, fraxetin, 1-acetyl-7-hydroxbeta-carboline, and 7-hydroxy-beta-carbo-line-propionic acid. In addition, the phytochemical analysis of the plant revealed that D. stramonium contained saponins, tannins, and glycosides [118, 119].

Studies on chemical analysis of A. caulirhiza indicated the presence of lipophilic alkylamides or alkamides bearing a different number of unsaturated hydrocarbons such as spilanthol [114, 127] and amide derivatives [128]. Due to the presence of spilanthol, the plant possesses analgesic effect and induces saliva secretion [129–131]. In addition, phytosterols, essential oils, sesquiterpenes, α- and β-bisabolenes and cadinenes, flavonoid glucoside, and a mixture of long-chain hydrocarbons were reported [132, 133]. The phytochemical analysis of A. sativum confirmed the presence of allicin [134, 135]. In addition, the aqueous and methanolic extract of A. sativum indicates the presence of a rich number of secondary metabolites such as alkaloids, flavonoids, glycosides, cardiac glycosides tannin, phenolic compounds, saponins, terpenoids, and steroids [136, 137].

3.6. Pharmacological Studies. While the phytochemistry of many medicinal plants has been analysed, some Ethiopian plants still lack comprehensive scientific data to validate the pharmacological effects of their respective chemical constituents to treat toothache. Among the studies on the pharmacological effect of medicinal plants used for the toothache treatment include the effect of allicin extracted from A. sativum. The plant inhibits the growth of Streptococcus mutans and reduces its acid production. It also increases the secretion of saliva and can be effective for the prevention and treatment of dental caries [134, 135]. The extract also showed inhibition against Porphyromonas gingivalis [115].

| Family         | Number of genera | Percentage | Number of species | Percentage |
|----------------|------------------|------------|------------------|------------|
| Asteraceae     | 10               | 8.5        | 12               | 9.2        |
| Fabaceae       | 8                | 6.8        | 9                | 6.9        |
| Solanaceae     | 3                | 2.5        | 5                | 3.8        |
| Euphorbiaceae  | 4                | 3.4        | 4                | 3.1        |
| Lamiaceae      | 5                | 4.3        | 5                | 3.8        |
| Oleaceae       | 3                | 2.6        | 4                | 3.1        |
| Rubiaceae      | 5                | 4.3        | 4                | 3.1        |
| Acanthaceae    | 3                | 2.3        | 3                | 2.3        |
| Boraginaceae   | 3                | 2.3        | 3                | 2.3        |
| Capparidaceae  | 4                | 3.4        | 4                | 3.1        |
| Ranunculaceae  | 3                | 2.3        | 4                | 3.1        |
| Rutaceae       | 4                | 3.4        | 4                | 3.1        |
| Malvaceae      | 3                | 2.3        | 3                | 2.3        |
| Other 49 families | 59              | 50.4       | 66               | 50.7       |
| Total          | 117              | 100.0      | 130              | 100.0      |

Table 2: Taxonomic diversity of medicinal plants used for toothache treatment.
Prashant et al. [138] and Hotwani et al. [139] examined the anti-toothache effect of A. indica and indicated that the extract reduces the frequency of early caries and reverses its process by decreasing the count of S. mutans, S. mitis, S. sanguinis, and S. salivarius. Pai et al. [140] also examined the pharmacological effect of the plant (A. indica) used to treat toothache and showed that extracts significantly decreased the plaque index and bacterial count.

Crude methanol, acetone, and chloroform extracts of D. stramonium exhibited antimicrobial properties against S. mutans and Candida albicans with varying inhibitory performances [141]. The minimum inhibitory concentration (MIC) reported by the authors was 80 mg/mL and 40 mg/mL against S. mutans and C. albicans, respectively. In a similar study conducted by Al-Ghamdi [142], the crude methanol leaves extract of D. stramonium showed no inhibitory activity against S. mutans, while the crude acetone extracts showed inhibitory activity at 4 mg/mL against S. mutans.

O. europaea (Oleaceae) is commonly known as olive tree. It is a tree bearing silvery green leaves and small white, feathery flowers [143]. O. europaea reported being an effective antimicrobial agent [144]. Stem extracts of O. europaea using petroleum ether, acetone, methanol, and water in soxhlet successively showed a broad spectrum of activity against microorganisms responsible for the most dental diseases [143]. Various authors reported that methanol extracts of O. europaea showed the maximum activity against S. mutans (16.6 mm) and C. albicans (13.6 mm). In another study by Sudjana et al. [145], the leaf extract showed activity against specific microbe and is not a broad-spectrum antimicrobial agent. Phenolic compounds from leaves of O. europaea also showed activity against C. albicans at low concentrations [146].

Bonou et al. [147] examined the activity of C. anisata on various oral pathogens and indicated that the extract from the plant is effective against C. albicans at 0.125 μg/mL. In a similar study, dichloromethane and methanol extracts of C. anisata showed sensitivity at 8 mg·mL⁻¹, 4 mg·mL⁻¹, and 8 mg·mL⁻¹ against S. mutans, C. albicans, and Lactobacillus acidophilus, respectively [148]. However, Kemoli et al. [149] observed no activity against S. mutans using the disc diffusion assay.

S. incanum fruits are locally used in Ethiopia to manage tooth decay, which is caused by mouth microbes [30, 49, 67, 68]. The pharmacological studies also proved that the fruit extracts of S. incanum inhibit the growth of oral microbes [150]. At the optimum concentration (70 μL), oral microbes were inhibited (1.8). The authors also reported that alkaloids and solasodine found in fruits are responsible for antimicrobial activity.

3.7. Future Research and Viewpoints. This study showed that local people in Ethiopia rely on traditional medicines to treat toothache and are knowledgeable about the applications of medicinal plants. However, the dose and part used vary among place to place even in a specific plant species. For instance, different parts of C. tomentosa were reported to be used for toothache treatment. Wondimu et al. [40] and Kassa et al. [49] indicated that local people in Arsi and Ejere used roots and barks of this plant to get relief from toothache, respectively. In another study, Beyi [30] reported that the leaves of C. tomentosa are used in toothache treatment by local communities of Dugda district. These types of findings could show the urgency of phytochemical and pharmacological studies in order to prove or disprove its potency against oral microbes. In doing so, the most potent plant part will be investigated and applied in toothache treatment.

The current review addresses the existence of traditional indigenous knowledge in Ethiopia on toothache treatment. It is, therefore, necessary to preserve this indigenous knowledge on traditional medicines by proper documentation, identification of plant species or parts used, herbal preparation, and dosage [103]. This review will assist future studies on the selection of herbal plants used to treat toothache or oral pathogens in phytochemical and pharmacological evaluation. As a contribution to the ongoing search for alternatives, available, safe, and effective treatment to conventional drugs used to treat toothache, it is necessary to advocate scientific research on anti-toothache plants. Plant species which are being frequently utilized by different groups of people either in Ethiopia or in the world could be evidence for the activity of plant species on toothache treatment. For example, D. stramonium has been cited 16 times by different ethnobotanical studies conducted in different parts of Ethiopia [41, 44]. The pest prepared from this plant is also used for toothache treatment by local communities living in the central Himalaya of India [151]. Other ethnobotanical studies on oral health treatment also correlated the use of S. incanum for toothache treatment similar to Ethiopian communities. For example, local communities in Madagascar use the fruits of S. incanum through buccal inhalation for toothache treatment [23]. In a similar study, C. tomentosa which is a frequently utilized toothache plant in Ethiopia [30, 40, 49, 68] is also reported to be used as anti-toothache by local communities of Burkina Faso [22].

Although societies in Ethiopia have long used these plant species for toothache treatment with no health complaints, it is a good practice to perform toxicological tests before implementing the pharmacological results in a community. It needs a thorough scientific investigation mainly on toxicity aspects. For instance, a toxicological study on D. stramonium indicated that the plant is toxic when consumed improperly [31, 152] and the administrations of large amounts affect the central nervous system [31]. To offset the effect of dose and toxicity, attempts should be made to standardize the dose and authenticate plant species with anti-toothache properties [153].

Regarding the effectiveness of medicinal plants on the toothache, continuous studies should be done to confirm the local medicinal plant knowledge with a scientific approach. In different pharmacological studies, it was noted that crude extracts of the plant species were tested on oral pathogens [141–143]. However, purification of the active component is essential to elucidate the mechanism and aid in future drug
development. It is also wise to study whether the components in crude extracts have a synergistic or antagonistic impact on oral pathogens inhibitory activity. The synergistic and antagonistic effect could be evaluated in both crude and fractionation (purified) form. If we decide to use the anti-toothache plants in their crude form, there might be a chance of achieving a synergistic effect and obtaining a better result. Studies have reported that pure drugs that are industrially produced or isolated from plants rarely have the same degree of activity as the unrefined extract at comparable concentrations or doses of the active component [154, 155]. This phenomenon is attributed to the absence of interacting substances present in the extract [154]. The synergy between different constituents of extracts has been documented in various pharmacological studies [155, 156].

A review by Woldeab et al. [103] highlighted that the number of informants who participated in ethnobotanical studies in Ethiopia is minimal similar to the finding of the current study. In this review, we found that the minimum number of participants was 30 in the study conducted by Birhanu and Ayalew [72] whereas the highest informants (1214) participated in the study by Flatie et al. [26]. The number of participants selected for ethnobotanical study in Ethiopia has no ground; rather, it depends on the will of researchers. In the future, a standard should be set on the number of informants to participate in ethnobotanical studies considering the geographical location, population size, and land size unless the sample size could not be representative to elucidate the medicinal plant knowledge of a given district [103]. Another concern of ethnobotanical studies conducted in Ethiopia is the age and sex of participants. Studies are concluding that the knowledge on medicinal plants is getting lost due to the lack of interest by the younger generation without concrete evidence [33, 98]. No comparative studies on the knowledge of medicinal plants have been made between young and old generations to reach the conclusion. In addition, a number of female participants were lower compared to male participants. On average, about 25 female respondents participated in each ethnobotanical study conducted in Ethiopia, whereas 64 males participated in each study. However, there were studies that collected data from an equal or a greater number of female participants [42, 55, 67, 85, 95]. Thus, future studies should focus on identifying gender-based knowledge differences related to medicinal plants use [103].

In Ethiopia, the knowledge of medicinal plants for toothache treatment only is poorly documented. Thus, future ethnobotanical studies should focus on the specific condition to gather as many as information related to the diseases. In doing so, a detailed preparation method, method of application, and other necessary information will be collected to aid future drug development.

4. Conclusions

The present study records 130 reported medicinal plants commonly used for toothache treatment in Ethiopia. The majority of traditional medicinal plants were harvested mostly from wild. In the study area, shrubs constituted the highest proportion of medicinal plants to be utilized for toothache treatment. Both leaves and roots are almost equally harvested to prepare the drug to get relief from the disease. The utilization of leaves may not cause a detrimental effect on the plants compared with plant species in which root is utilized. The review also found that medicinal plants such as Acmella caulirhiza, Allium sativum, Capparis tomentosa, Clausena anisata, Datura stramonium, Ehretia cymosa, Eucolea racemosa, Premna schimperi, and Solanum incanum were reported by more than four researches in different parts of Ethiopia which might indicate the availability and efficacy of the plant species for toothache treatment. Hence, they have the potential to be developed into agents that can be used as a treatment therapy for toothache treatment. Study on the toxicological effects of plants should not be overlooked, as the main aim for studying indigenous plants is linked with searching safer and effective alternatives to modern drugs used for toothache treatment which are costly and very often require prolonged treatment.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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