A Review on Medicinal Plants Used in the Management of Respiratory Problems in Ethiopia over a Twenty-Year Period (2000–2021)

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This review is aimed at assessing and compiling the different ethnomedical studies in different parts of Ethiopia used to treat respiratory diseases. The data were collected from different published research papers through searching the web sources such as PubMed, Science Direct, Google Scholar, and other related websites. The important search terminologies included ethnobotany, respiratory diseases, medicinal plants, and Ethiopia. For this, a total of 65 articles of recent publications (from 2000 to May 2021 years) that provided full information about the use of medicinal plant species to treat respiratory disorder diseases in Ethiopia were consulted. Based on this, a total of 96 medicinal plants belonging to 57 families were reviewed. The commonly recorded families used to manage respiratory problems were Asteraceae, Lamiaceae, Solanaceae, and Fabaceae. Herbs and shrubs were the dominant plant growth forms. Due to the easiest form of their preparation for treating respiratory disorders, leaves are the most cited plant parts followed by roots. Crushing and pounding are useful methods of remedy preparation to treat respiratory diseases. This review concluded that different medicinal plants have a significant contribution in combating serious respiratory problems in Ethiopia. Hence, the compiled review of medicinal plants on the treatment of respiratory problems would play a great role in further pharmacological and phytochemical investigations in developing new drugs used for the treatment of respiratory problems and in the conservation of these important medicinal plants.

1. Introduction

The respiratory system is a network of organs and tissues that make respiration possible by making the body absorb oxygen from the air so that organs can function. It cleanses the blood of harmful gases such as carbon dioxide. The respiratory organ system includes airways, the lungs, and blood vessels. The respiratory system can be divided into the upper and lower respiratory tracts. Due to its size, the respiratory system is constantly exposed to microbes [1]. Respiratory infections are the most common of all human infections [2, 3]. This infection is a major cause of death, especially in patients with severe disease. Lower respiratory tract infections have a wide range of symptoms, including acute bronchitis, pneumonia, and chronic obstructive pulmonary disease, which can include symptoms such as cough, nausea, dyspnoea, shortness of breath, and/or chest pain. Common problems include a series of illnesses, including allergies. The incidence and severity of these diseases continue to be high both in developed and developing countries [4]. Upper respiratory tract infections can be defined as self-limited irritation and swelling of the upper airways with associated cough and no signs of pneumonia, in a patient with no other condition that would account for their symptoms, or with no history of chronic obstructive pulmonary disease, emphysema, or chronic bronchitis [5, 6]. Upper respiratory tract infections involve the nose, sinuses, pharynx, larynx, and large airways. The most common
respiratory problems are asthma, bronchitis, colds, and coughs [7]. The World Health Organization (WHO) estimates that noncommunicable diseases (NCDs) represent 63% of all global deaths of which 3.9 million are due to chronic respiratory diseases (CRDs) and chronic obstructive pulmonary disease (COPD) in particular [8]. In 2001, noncommunicable diseases accounted for 54% of deaths in low and middle income (developing) countries and 87% of deaths in high income (developed) countries [9]. The global and national burden and threat of noncommunicable diseases (NCDs) constitute a major public health challenge of the 21st century that undermines the social and economic development worldwide and in Ethiopia. To mitigate their impact urgent action is required.

Acute pneumonia is a major cause of infant mortality in the world, accounting for 16% of all deaths worldwide. Some studies have also reported that high rates of acute respiratory infections in Ethiopia range from 16% to 33.5% [10]. In third world countries, where effective air pollution reduction strategies are inadequate, individuals are constantly exposed to substances that have negative health effects in the short and long term [11]. Various vulnerabilities are related to chronic respiratory diseases, including smoking habits, environmental conditions, and personal cooking/heating pollution [12–16].

With regard to the cure of these highly treatable respiratory diseases, the World Health Organization (WHO) is promoting herbal medicine and pharmacological research to make better use of herbal remedies [17]. The use of herbal remedies for the treatment of respiratory disorders is common practice in many parts of the world [18]. Traditional medicine has been an important source of products for developing countries in treating common infections [19].

Medicinal plants are very vital in their uses for medication, besides providing ecological, economic, and cultural services. The world’s primary means of treating diseases and fighting infections have been based on the use of medicinal plants. From ancient times, plants have been a rich source of effective and safe medicines [20]. In the world, 64% of the population relies on medicinal plants to treat health problems [21].

In Ethiopia, there are different medicinal plants that are used to treat various respiratory ailments like Zingiber officinale Roscoe, Ocimum lamifolium Hochst. ex. Benth, Artemisia abyssinica Sch. Bip. ex A. Rich, Carthamus tinctorius L, and Solanecia gigas (Vatke) C. Jeffrey. However, the effectiveness of these medicinal plants has not yet been scientifically investigated. Recent studies revealed that antimicrobial medicinal plants were investigated scientifically in different countries [22, 23]. Some of the medicinal plants used to treat respiratory disorders were investigated experimentally in vitro such as the extracts from Gnaphalium oxyphyllum Steetz ex Griseb, Gnaphalium americanum Mill, and Crescentia alata Kunth possessed strong antimicrobial activity against Staphylococcus aureus, Enterococcus faecalis, Streptococcus pneumoniae, Streptococcus pyogenes, and Candida albicans [19]. Moreover, the oils of Lavandula augustifolia Mill, Elettaria cardamomum (L.) Maton, and Cymbopogon nardus (L.) Rendle are major constituents against respiratory tract pathogens by gaseous contact [24]. Kariuki and Njoroge [25] similarly reported that methanolic extracts of Acacia nilotica and Strychnos henningeri showed efficacy against S. aureus, S. pneumoniae, and E. coli [25].

Panax ginseng aqueous extract prevents pneumococcal sepsis in vivo by potentiating cell survival and diminishing inflammation. Taken together, 100 mg/kg of KRG appeared to protect host cells from lethal pneumococcal sepsis by inhibiting inflammation as well as by enhancing bacterial clearance thereby reinforcing cell survival against pneumococcal infection [26].

Ginseng has been traditionally used in Asia for thousands of years to treat a variety of ailments including respiratory diseases. Various studies have shown that both families of compounds can modulate various parameters of the immune response in vitro and in vivo [27]. In clinical trials, healthy subjects that consumed a standardized ginseng extract had a lower incidence of influenza and colds, higher antibody titers, and higher natural killer cell activity [28], as well as increased numbers of total lymphocytes and T helper cells [29]. Ginseng polysaccharide preparations increased cytokine production and mRNA expression by murine macrophages and spleen cells in vitro [30].

The present study is aimed at documenting the traditional uses of medicinal plants used to treat different respiratory disorders in Ethiopia. This review describes the traditional uses of medicinal plants used for the treatment of respiratory disorders in Ethiopia. In general, this review is initiated to identify research gaps and to suggest perspectives for future research in the development of drugs used to treat various respiratory disorders.

2. Materials and Methods

2.1. Search Strategy. A systematic review of medicinal plants used to treat respiratory disorders in Ethiopia was conducted.

The data for this review were collected from different published articles via downloading them from web sources of PubMed, Science direct, Google scholar, and other related web sites following [31]. Accordingly, ethnobotanical/ethnomedicinal studies reporting on medicinal plants used for traditional respiratory disorder treatment in Ethiopia were gathered through different search approaches such as the Google search engine for published journal articles using international scientific databases including PubMed, Science Direct, Web of Science, and Google scholar. Similarly, missing information from some studies, especially the local, scientific, and family names of plants, was retrieved from the African Natural Database (NDA), version 2.0, as well as online plant scientific checking system for some other plant species was applied. During the search, the terms such as “medicinal plants,” “Ethnobotanical study,” and “Ethiopia or Indigenous people,” “respiratory medicinal plants,” “cough/traditional medicinal plants,” “common cold/traditional medicinal plants,” “tonsillitis/traditional medicinal plants,” etc. were used. The medicinal plants used to treat respiratory
disorders were included based on the eligibility criteria as described below.

2.2. Inclusion and Exclusion Criteria. Articles published only from 2000 to May 2021 were selected. Accordingly, the data collected from the literature included the plant species and its parts, used growth forms, local names, and modes of preparation and/or application. Moreover, the literature search was done to document the biological and pharmacological activities of mostly used plant species for treatment of respiratory disorder problems.

As depicted in Figure 1, 2502 articles were downloaded from different web sources. However, only 65 articles that provided full information about the use of medicinal plant species to treat respiratory disorder diseases in Ethiopia were selected and considered for this review paper (Figure 1).

3. Results and Discussion

3.1. Composition and Diversity of Medicinal Plants Used to Treat Respiratory Disorders. The reviews made from 65 articles identified 96 medicinal plants that contain full information on how to treat respiratory disorders in the country (Table 1). These plants were collected from different regions. Many of them were collected from Amhara (55.1%), Oromia (23.71%), SNNP (22.45%), and Tigray (6.122%) regional states (Figures 2 and 3), which cover close to 90–95% of the land size of the country, Ethiopia. This is consistent with other reviews made by Megersa et al. [85] on the treatment of toothache and [31] on the treatment of malaria, and also by Bitew et al. [86] on the treatment of wounds. This indicated that other regions were given less attention towards ethnobotanical study, which might be due to their being less studied and having a small land area compared to other regions mentioned here.

According to this review, of the total (96), 16.66% medicinal plants belonged to the Asteraceae and Lamiaceae families, which are equally dominant (Figure 4). Many ethnobotanical studies showed that the family Asteraceae was ranked first at the family level as indicated by Tesfaye et al. [32, 87]. This indicates that many of the medicinal plants used for treating respiratory disorders belong to the two dominant families, and that giving priority to these families in the conservation of medicinal plants is very vital.

3.2. Habits (Growth Forms) of Medicinal Plants. Herbs were the dominant plant growth form used to treat respiratory illness according to the current review which accounted for 39 (39.8%) plant species followed by shrubs at 36 (37.11%) (Figure 5). This result is consistent with many publications [12, 32, 52].

3.3. Plant Parts Used to Treat Respiratory Diseases. Leaves were the most important plant parts used to prepare medicines which accounted for about 31 plant species, while roots were the next most important part of plants which accounted for about 19 (Figure 6). This is in agreement with findings on other diseases [100–105]. Using the leaves of plants for medicinal preparation has advantages for the survival of the mother plants, whereas using the root parts of the medicinal plants could have threats to these medicinal plants because such practices totally remove the mother trees.

3.4. Methods of Preparation of Medicinal Plants Used to Treat Respiratory Diseases. Medicinal plants used to treat respiratory diseases are prepared in a variety of ways. The main methods are pounding and crushing (Figure 7). Fresh preparations are usually preferred by herbalists. This finding is in line with [43–47].

3.5. Numbers of Medicinal Plants Used to Treat Respiratory Disease. Current studies show that cough is cured by 45 plants and tonsillitis by 34 plants (Table 2). This implies that...
| Plant family | Scientific name | Online references for each plant species | Local name | Habit | parts used | Preparation methods | Traditional use | References |
|-------------|-----------------|------------------------------------------|------------|-------|-----------|---------------------|-----------------|------------|
| Acanthaceae | Justicia schimperiana (Hochst. Ex Nees) T.Anders. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:51563-1 | Smiza/sensl (Am) | Shrub | Leaf | Rubbing & sniffed | Common cold | [32] |
| Acanthaceae | Hypoestes forskaolii (Vahl) R.Sch | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:941349-1 | Girbia (Tig) | Herb | Root | Fumigation | Cough | [33, 34] |
| Alliaceae | Allium sativum L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:528796-1 | Shinkurt (Am) | Herb | Bulb & leaf | Chewed, chopped, pounded | Tonsillitis, cough, common cold | [35, 36] |
| Amaranthaceae | Achyranthes aspera L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:2468-2 | Telenj (Am) | Herb | Leaf | Crushed, decoction, boiled | Common cold | [32, 37, 38] |
| Anacardiaceae | Schinus molle L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:71044-1 | Qudabarbare (oro) | Tree | Seed | Chewed | Tonsillitis | [32, 39] |
| Annonaceae | Uvaria leptocladon Oliv. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:75780-1 | Zebko (KA) | Tree | Root | Crushed, decoction, boiled | Cough, chest pain | [40] |
| Apiaceae | Foeniculum vulgare Miller | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:842680-1 |Ensilal (Am) | Herb | Above ground | Boiled | Cough | [32, 41] |
| Apiaceae | Coriandrum sativum L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:840760-1 | Dimbilal (Am) | Herb | Seed | Grounded | Cough | [42] |
| Apiaceae | Nigella sativa L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:711687-1 | Tiqur-armud (Am) | Herb | Seed | Grounded | Common cold, Asthma | [43, 44] |
| Apocynaceae | Carissa spinarum L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:77756-1 | Laadiya (daw) | Shrub | Leaf & fruit | Chewed, Chopped, Grounded | Tonsillitis | [35, 45, 46] |
| Asclepiadaceae | Kanahia laniflora (Forsk.) R.Br | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:98887-1 | Tifiindio (Am.) | Herb | Root/leaf | Sniffing, inhaling | Flu, asthma bronchitis | [47, 48] |
| Asparagaceae | Asparagus africanus Lam | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:530996-1 |Yest kest (Am) | Herb | Root | Boiled, decoction | Cough | [49] |
| Asteraceae | Echinops kebericho Mesfin | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:94077-1 | Kebericho (Am) | Herb | Bulb | Smoked | Cough | [50] |
| Asteraceae | Acmella caulirhiza Del | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:174533-1 | Gutichaa (Oro) | Herb | Flower | Chewed and spitted | Tonsillitis | [51, 52] |
| Asteraceae | Lagerra tomentosa (Sch. Bip.ex A. Rich.) Oliv. & Hiern | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:6045903-2 |Nech kese (Am) | Herb | Leaf | Holding | Common cold/cough | [53] |
| Asteraceae | Vernonio amygdalina Delile | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:257798-1 | Grawa (Am) | Shrub | Leaf | Crushed | Tonsillitis | [54] |
| Asteraceae | Kleinia abyssinica (A. Rich.) A. Berger | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:227346-1 |Este-maza (Am) | Herb | Leaf | Squeezed, drunk | Tonsillitis | [55] |
| Asteraceae | Helianthus annuus L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:119003-2 | Suf (Am) | Herb | Seed | Decoction | Coughing, common cold | [56] |
| Plant family | Scientific name | Online references for each plant species | Local name | Habit | parts used | Preparation methods | Traditional use | References |
|--------------|-----------------|------------------------------------------|------------|-------|-----------|---------------------|----------------|-----------|
| Asteraceae   | Artemisia absinthium L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:300106-2 | Aritii (oro) (Am) | Herb | Root & leaf | Pounded | Sour throat/ tonsillitis | [51, 57] |
|               | Guizotia abyssinica (L.) Cass. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:210735-1 | Nig (Am) | Herb | Seed | Pounded | Dry cough | [58] |
| Balsaminaceae | Impatiens ethiopica Grey-Wilson | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:103607-1 | Insosla (Am) | Herb | Root | Crushing and Pounding | Cough | [59] |
| Boraginaceae  | Trichodesma zeylanicum (Burm. f.) R. Br | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:121302-1 | Igwusha (Gum) | Shrub | Root | Crushed, squeezed | Tonsillitis | [60] |
| Brassicaceae | Lepidium sativum L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:138141-2 | Feecoo (oro)/feto (Am) | Herb | Seed | Pounded | Common cold | [61] |
| Brassicaceae | Brassica nigra (L) Czern | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:60442520-2 | Sanafica (oro) | Herb | Seed | Pounded | Common cold | [61] |
| Canellaceae  | Warburgia ugandensis Sprague | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:146038-1 | Befi (oro) | Tree | Stem | Sniffed smoke | Cough | [62] |
| Capparidaceae | Capparis tomentosa Lam. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:146824-1 | Gumero (Am) | Shrub | Fruit | Grinding, chewing | Tonsillitis | [43] |
| Caricaceae   | Carica papaya L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:77126657-1 | Papaya (Am) | Tree | Root | Crushed and boiled | Cough | [32] |
| Celastraceae | Catha edulis (Vahl) Endl | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:941530-1 | Chat (Am) | Shrub | Leaf & stem | Boiled, drunk | Cough | [63] |
| Crassulaceae | Kalanchoe laciniata (L) DC | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:274383-1 | Anchura (oro) | Herb | Root | Pounded | Cough | [64] |
| Cucurbitaceae | Momordica foetida Schumach | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:293451-1 | Yubarrae (Ged) | Shrub | Roots | Crushed pounded | Bronchitis | [32, 47] |
| Cucurbitaceae | Cucumis ficifolius A. Rich | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:292191-1 | Yemidir Embuy (Am) | Climber | Root | Washed, smashed mixed with water | Cough bronchitis | [43, 65] |
| Cupressaceae | Juniperus procera Hochst. ex Endl. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:262311-1 | Yehabeshatisd (Am) | Herb | Stem/ root | Grinding/boiling | Cough | [62] |
| Euphorbiaceae | Euphorbia schizantha Pax | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:348181-1 | Dhetungayda (Kr) | Herb | Leaf | Pounded | Cough | [50] |
| Euphorbiaceae | Tragia pungens (Forsk.) Muell. Arg | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:357857-1 | Alelabit (Am) | Climber | Root & leaf | Powdered, boiled decoction | Chronic cough (T.B) | [66] |
| Euphorbiaceae | Croton macrostachyus Hochst. ex Delile | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:342971-1 | Tesana (Oro) | Tree | Twig | Crushed, drunk | Tonsillitis | [60, 67] |
| Euphorbiaceae | Ricinus communis L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:355348-1 | Qolombo desha (kw) | Tree | Root | Chewing/ crushed boiled | Flu | [40, 68] |
Table 1: Continued.

| Plant family | Scientific name                  | Online references for each plant species | Local name         | Habit | parts used | Preparation methods | Traditional use            | References |
|--------------|----------------------------------|-----------------------------------------|--------------------|-------|------------|---------------------|---------------------------|------------|
| Fabaceae     | Albizia amara (Roxb.) Boivin     | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:473171-1 | Ondoddee (Kr)      | Tree  | Leaf       | Crushed             | Cough                     | [48, 53]   |
| Fabaceae     | Acacia tortilis (Forsk.) Hayne    | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:471662-1 | Tadacha (Am)       | Tree  | Leaf       | Concoction          | Throat infection          | [69]       |
| Fabaceae     | Acacia nilotica (L.) P.J.H.Hurter & Mabb. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:77089275-1 | Kasalto [Af]       | Tree  | Stem bark  | Infusion            | Tonsillitis               | [70]       |
| Fabaceae     | Tephrosia elata Deflers          | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:520536-1 | Kashabach (Tig)    | Shrub | Root       | Grounded            | Respiratory tract problem  | [71]       |
| Fabaceae     | Acacia oerfota (Forsk.) Schweinf | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:520536-1 | Ajo (oro)          | Shrub | Bark       | Chewed              | Tonsillitis               | [72]       |
| Flacourtiaceae | Dovyalis abyssinica (A. Rich.) Warb. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:111558-1 | Koshim (Am)        | Shrub | Leaf       | Boiling             | Asthma                    | [58]       |
| Lamiaceae    | Ocimum lamifolium Hochst. Ex Benth. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:453009-1 | Damakase (Ged) (Am) | Herb  | Leaf       | Pounded             | Cough/nose bleeding/Influenza | [47, 73]   |
| Lamiaceae    | Clerodendrum myricoides (Hochst.) R.Br. Ex Vatke | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:862273-1 | Misrich (Am)/Bishchereh (Br) | Shrub | Root bark  | Decocted             | Dry cough/common cold      | [64, 74]   |
| Lamiaceae    | Thymus serulatus Hochst. ex Benth. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:461653-1 | Tosigne (Am)       | Herb  | Leaf       | Boiled              | Whooping cough             | [73, 75]   |
| Lamiaceae    | Clerodendrum alatum Gurke       | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:861906-1 | Misrich (Am)       | Herb  | Bark       | Pounded             | Tonsillitis                | [37]       |
| Lamiaceae    | Ajuga integrifolia Buch.-Ham. ex D.Don | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:444959-1 | Tut astil (Am)     | Herb  | Leaf       | Rubbed, Squeezed    | Tonsillitis                | [54]       |
| Lamiaceae    | Mentha spicata L.               | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:30816167-2 | Nana (oro)         | Herb  | Leaf       | Boiled, drunk       | Cough and cold             | [57]       |
| Lamiaceae    | Ranunculus multifidus Pursh     | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:217450-2 | Afì Deshe (Am)     | Herb  | Leaf       | Pounded             | Tonsillitis                | [76]       |
| Lamiaceae    | Orostegia fruticosa (Forsk.) Schweinf. ex penzig | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:453638-1 | Tunjut (Am)        | Shrub | Leaf       | Burning             | Common cold                | [77]       |
| Loganiaceae  | Buddleja polystachya Fresen.    | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:545859-1 | Anfar (Am)         | Shrub | Shoot      | Concoction          | Tonsillitis                | [32, 78]   |
| Loganiaceae  | Nuxia congesta R.Br. Ex Fresen. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:546816-1 | Atquar (Am)        | Shrub | Shoot      | Rub, squeeze        | Tonsillitis                | [32]       |
| Malvaceae    | Gossypium barbadense L.          | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:559677-1 | Tit (Am)           | Shrub | Fruit      | Grounded            | Tonsillitis                | [32]       |
| Malvaceae    | Sida rhombifolia L.             | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:235798-2 | Karaba (Oro)       | Shrub | Leaf       | Boiled              | Asthma                     | [79]       |
| Plant family | Scientific name | Online references for each plant species | Local name | Habit | parts used | Preparation methods | Traditional use | References |
|--------------|-----------------|------------------------------------------|------------|-------|------------|---------------------|----------------|------------|
| Meliaceae    | *Azadirachta indica* A. Juss. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:1213180-2 | Nim (Am) | Tree | Leaf | Boiled | Cough | [59] |
| Meliaceae    | *Berchemia abyssinica* Fresen. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:78217-1 | Xibiro (oro) | Shrub | Root | Crushed | Bronchitis | [61, 69] |
| Menispermaceae | *Stephania abyssinica* (Quart.-Dill. & A.Rich.) Walp | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:581384-1 | Chewchawit (Am) | Herb | Shoot | Crushed | Tonsilitis | [32] |
| Moraceae     | *Dorstenia burmanniana* Schweinf. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:60453233-2 | Work Bemeda (Am) | Herb | Root | Infusion | Acute coughing | [79] |
| Myrataceae   | *Eucalyptus globulus* St.-Lag. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:592964-1 | Tsadakelamitos (Tig) | Tree | Leaf | — | Cough | [80] |
| Myricaceae   | *Myrica salicifolia* Hochst. ex A.Rich. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:585605-1 | Shinet (Am) | Tree | Bark | Crushed, powdered | Common cold & bleeding | [32] |
| Myrsinaceae  | *Maesa lanceolata* Forssk. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:588843-1 | Gegge‘uwa (daw) | Tree | Leaf, bark and seed | Chopped, Pound; ground | Tonsilitis | [35] |
| Myrtaceae    | *Syzygium guineense* (Wild.) DC. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:601750-1 | Ochaa (daw) | Tree | Leaf root and bark | Chopped | Tonsilitis/flu & sore throat | [35] |
| Myrtaceae    | *Eucalyptus globulus* Labill. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:592965-1 | Nech bahrzaf (Am) | Tree | Leaf | Burning | Common cold | [36] |
| Nyctaginaceae | *Commicarpus sinuatus* Meikle | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:604483-1 | Kontom (Or) | Herb | Leaf | Concoction | Throat infection | [69] |
| Olacaceae    | *Ximenia americana* L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:316341-2 | Hudhaa (oro) (KA) Walojwole (KW) | Shrub | Root | Crushed, pounded | Tonsilitis, Flu | [40, 57] |
| Oleaceae L.  | *Olea europaea* | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:610675-1 | Woira (Am) | Tree | Leaf | Chewed | Tonsilitis | [32] |
| Phytolaccaceae | *Phytolacca dodecandra* L’Her | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:678349-1 | Shebti (Tig) | Shrub | Root | Juice | Cough | [81] |
| Piperaceae   | *Piper capense* L.f. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:680780-1 | Timiz (Am) | Shrub | Seed | Powdered | Cold, cough | [56] |
| Plumbaginaceae | *Plumbago zeylanica* L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:687109-1 | Amira (Am) | Shrub | Leaf | Boiled, drunk | Cough asthma | [82] |
| Poaceae      | *Cymbopogon citratus* (DC.) Stapf | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:396896-1 | Xajisaara (oro) | Herb | Leaf | Burnt | Cough | [57] |
| Poaceae      | *Saccharum officinarum* L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:419977-1 | Shankora (Am) | Shrub | Stem | Ate | Common cold | [83, 84] |
| Podocarpaceae | *Podocarpus gracilior* Pilg. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:262407-1 | Zigba (Am) | Tree | Sap | Crushing | Common cold | [28–89] |
| Plant family | Scientific name | Online references for each plant species | Local name | Habit | parts used | Preparation methods | Traditional use | References |
|--------------|-----------------|------------------------------------------|------------|-------|-----------|---------------------|-----------------|------------|
| **Polygalaceae** | Polygala obtusissima Hochst. ex Chodat | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:691954-1 | Calmala (Af) | Shrub | Leaf | Pounded | Common Cold | [69] |
| **Polygonaceae** | Rumex nepalensis Spreng | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:697338-1 | Zan’s’alaa (dawro)/tuft (Am) Tului (oro) | Herb | Root & leaf | Chewed | Tonsillitis | [35, 90] |
| **Ranunculaceae** | Clematis hirsuta Guill. & Perr. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:709771-1 | Azo Hareg (Am) | Climber | Leaf | Juice | Cough | [91] |
| **Rhamnaceae** | Rhamnus prinoides L’Herit | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:718580-1 | Geeshuwa (daw) | Shrub | Leaf | Pounded; Chewed | Tonsillitis | [35, 92] |
| **Rosaceae** | Prunus Africana (Hook.f) Kalkman | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:729417-1 | Tikur Inchet (Am) | Tree | Leaf | Pounded | Tonsillitis | [66] |
| **Rubiaceae** | Rubia cordifolia L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:765218-1 | Enchibir (Am) | Herb | Root & leaf | Powdered, boiled decoctio, | Cold, cough | [66] |
| **Rubiaceae** | Coffea arabica L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:747038-1 | Buna (Am) | Shrub | Seed | Decoction | Asthma | [54] |
| **Rutaceae** | Citrus limon (L.) Osbeck | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:6045478-2 | Lomae (Ged) lomi (Am) | Shrub | Fruit | Chew | Cough | [47, 93] |
| **Rutaceae** | Citrus aurantiifolia (Christm.) Swingle | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:59599-2 | Tutto (kr) | Shrub | Fruit | Juice | Cough | [48] |
| **Rutaceae** | Ruta chalepensis L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:770131-1 | Chelatama (oro) | Shrub | Fruit | Boiled | Cough | [62] |
| **Santalaceae** | Osyris lanceolata Hochst. & Steud. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:780506-1 | Waatoo (oro) | Shrub | Root, stem | Grinding, Powdering | Common cold | [94] |
| **Scrophulariaceae** | Verbascum sinaiticum Benth | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:770370-1 | Tirnake (Tig) | Herb | Root | Crushed | Tonsillitis | [95] |
| **Solanaceae** | Solanum incanum L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:819567-1 | Hiddi (oro) | Shrub | Fruit | Juice | Tonsillitis | [39] |
| **Solanaceae** | Solanum marginatum Lf | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:819994-1 | Yebeda enboy (Am) | Shrub | Fruit | Juice | Cough | [32] |
| **Solanaceae** | Withania somnifera (L.) Dunal | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:821709-1 | Giziewa (Am) | Shrub | Leaf | Crushed | Cough/Asthma | [32] |
| **Solanaceae** | Datura stramonium L | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:314738-2 | Manjii (oro) | Herb | Leaf | Pounded, drunk | Cough | [92] |
| **Solanaceae** | Solanum dasyphyllum Schumach &Thonn | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:818913-1 | Geber enbuay (Am) | Shrub | Leaf | Crushed | Nosebleed | [96, 97] |
| **Solanaceae** | Solanum incanum L. | https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:819567-1 | Buluwaa (ko) | Shrub | Fruit | Homogenized | Cough | [98] |
Table 1: Continued.

| Plant family | Scientific name | Online references for each plant species | Local name | Habit | parts used | Preparation methods | Traditional use | References |
|--------------|-----------------|------------------------------------------|------------|-------|-----------|---------------------|----------------|------------|
| Tiliaceae    | *Grewia ferruginea* Hochst ex A. Rich | [https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:834226-1](https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:834226-1) | Ogomdii (Ged) | Shrub | Root bark | Crushed | Cough | [43] |
| Verbenaceae  | *Lippia adoensis* Hochst. ex Walp | [https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:863500-1](https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:863500-1) | Kusaayee (oro) | Shrub | Leaf | Pounded, drunk | Cough | [92] |
| Verbenaceae  | *Verbena officinalis* L. | [https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:330554-2](https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:330554-2) | Atuch (Am) | Herb | Twig | Crushed | Tonsillitis | [32, 71] |
| Verbenaceae  | *Aloysia triphylla* Britton | [https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:9688-2](https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:9688-2) | Xuxxoo (oro) | Tree | Leaf | Pounded | Tonsillitis | [65] |
| Vitaceae     | *Cyphostemma adenocaule* (Steud. Ex A.Rich.) Desc. ex wild & R.B.Drumm | [https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:870171-1](https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:870171-1) | Mrkuszibei (Tig) | Herb | Root | Chewed | Tonsillitis | [53] |
| Zingiberaceae| *Zingiber officinale* Roscoe | [https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:798372-1](https://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:798372-1) | Zinjiblaa (oro) zinjble (Am.) | Herb | Root | Crushed & boiled | Cough, cold & tonsillitis | [54, 64, 99] |

Figure 2: Regional states of Ethiopia, where medicinal plants are found and reviewed.

Figure 4: Taxonomic diversity of the families of medicinal plants with their percentages in the study area.

Figure 3: Number of ethnobotanical studies which contain full records of medicinal plants used to treat respiratory diseases in different regions of Ethiopia (Note. SNNP = South nation and nationality of people; B. Gumuz = Benishangul Gumuz).

Figure 5: Growth forms of medicinal plants used to treat respiratory diseases.
Table 2: Number of medicinal plants used to treat each type of respiratory diseases.

| No  | Respiratory disease | Number of medicinal plants | Percentage |
|-----|---------------------|-----------------------------|------------|
| 1   | Cough               | 45                          | 46.4       |
| 2   | Tonsillitis         | 34                          | 35.05      |
| 3   | Bronchitis          | 4                           | 4.1        |
| 4   | Common cold         | 16                          | 16.5       |
| 5   | Flu                 | 4                           | 4.1        |
| 6   | Sore throat         | 1                           | 1.03       |
| 7   | Bleeding            | 2                           | 2.06       |
| 8   | Influenza           | 1                           | 1.03       |
| 9   | Asthma              | 8                           | 8.25       |
| 10  | Respiratory tract problem | 1                | 1.03       |
| 11  | Throat infection    | 2                           | 2.06       |
| 12  | Chest pain          | 1                           | 1.03       |

cough and tonsillitis could be treated by different medicinal plants, so that the shortage of medicinal plants might not be the problem even during the dry seasons. On the contrary, some respiratory diseases such as sore throat, respiratory tract problems, and chest pain can be cured only by one type of medicinal plant (1.03%). This could be a risk for treating these diseases whenever there is a drought and/or other man-made or natural crisis as the medicinal plants might disappear in such situations. This is consistent with

4. Conclusions and Recommendations

From times in memorial, traditional medicinal plants were being used to treat various ailments including respiratory illnesses. In Ethiopia, 96 medicinal plants are being used to cure respiratory problems. It is necessary that attention should be given to the sustainable use of these plant species and further pharmacological studies should be conducted to extract and use the active medicinal ingredients. This study, we believe, is a gateway for many researchers to give more emphasis on how to extract and develop new drugs to treat respiratory health problems.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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