Heartburn and effective herbal remedies: A systematic review study in Iranian ethnobotanical documents

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ABSTRACT

Every year, millions of people worldwide get sick with gastrointestinal diseases such as heartburn. Certain herbs contribute to the alleviation of heartburn, nausea, and improvement of digestion. Moreover, these herbs do not have as many side effects as synthetic drugs. As a health problem and one of the challenging issues in medical sciences, heartburn is common in children and adults worldwide. Hence, in the present study, we tried to report medicinal plants used in cultures and traditions of different regions of Iran to treat heartburn in children and adults. In this review study, articles of Iranian ethnobotanical sources were searched with the keywords of ethnobotanics, heartburn, children, adult, medicinal plants, and Iran. Journal articles published from 2010 to 2019 in several Iranian and International databases, including ISI Web of Science, PubMed, Scopus, ISC, and Magiran, were searched to find relevant articles and information. Anethum graveolens L., Punica granatum L., Mentha pulegium, Thymus kotschyanus Boiss. & Hohen., Achillea millefolium, Ocimum basilicum, Nigella sativa, etc., are the plants used in different parts of Iran to treat heartburn. Hence, these medicinal plants might be considered as a natural source for preparation of new drugs to treat heartburn.

Implication for health policy/practice/research/medical education:
This review provides a detailed insight into the medicinal plants effective on heartburn and shows that Iranian ethnobotanical sciences provide a list of natural treatments for heartburn, which can be used as a reliable source for preparation of new drugs for children and adult.

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upset the baby (10-12).
Herbs are used to treat common side effects of various diseases, and heartburn is one of the most common gastrointestinal side effects from which many people suffer (13). Medicinal plants are ethnomedical and ethnomedical sources for the treatment of diseases. Studies have indicated the active ingredients and medicinal as well as antioxidant compounds of medicinal plants enable them not only to have beneficial effects on human health but also to have therapeutic effects on various organs of the body and various diseases (14-20). Some herbs contribute to the alleviation of heartburn, nausea, and improvement of digestion. Furthermore, although these herbs do not have as many side effects as chemicals, they should not be taken without a prescription from a traditional healer. Useful herbs are found in nature and could be used to treat stomach ailments and disorders. Some studies have shown that many of these plants cure diseases even better than chemical drugs. These plants also have no side effects unlike chemical drugs. Heartburn is common in both children and adults worldwide and is one of the health problems and challenges of medical science. Hence, in this study, we tried to report medicinal plants used in cultures and traditions of different regions of Iran to treat heartburn in children and adults.

Methods
In this review study, the articles of Iranian ethnomedical sources were searched with the keywords of ethnobotanics, heartburn and Iran. We searched for articles and information published from 2010 to 2019 in databases inside and outside Iran, including ISI Web of Science, PubMed, Scopus, ISC, and Magiran. In the present study, 48 articles were searched. There were two duplicate articles that were omitted. Three articles also lacked full text. Out of the 43 remained articles, only 15 articles contained ethnomedical information on heartburn in children and adults in Iran. The flowchart of the search strategy and the criteria for entering and leaving the articles is specified in Figure 1.

Results
Anethum graveolens L., Punica granatum L., Mentha pulegium, Thymus kotschyanus Boiss. & Hohen., Achillea millefolium, Ocimum basilicum, Nigella sativa, etc., are the plants used in different parts of Iran to treat heartburn. Additional information on the medicinal plants, scientific name, plant family name, the area used and the organs used have been listed in Table 1. The chemical composition of each herbal plant can exert a variety of medicinal properties, including therapeutic properties, on gastrointestinal disorders and syndromes. In this study, the main chemical compounds of each herb were also reviewed and extracted. The main chemical compounds and formulas of each medicinal plant have been listed in Table 1.

Discussion
Ethno-botany focuses on using plants by a particular ethnic group in an area of plants and is useful for extracting indigenous knowledge of medicinal plants used to treat various diseases. Different regions of Iran

![Figure 1](http://www.herbmedpharmacol.com)
Table 1. Anti-heartburn plants based on Iranian ethnobotanical sources

| Scientific name                      | Herbal family    | Persian name | Used organ                  | Region              | Main compound                      | Chemical formula |
|--------------------------------------|------------------|--------------|-----------------------------|---------------------|------------------------------------|------------------|
| *Foeniculum vulgare* Mill.           | Apiaceae         | Razianeh     | Fruit, branches and leaves  | East Khuzestan (21) | Trans-Anethole                     | C₈H₁₂O            |
| *Heracleum persicum* Desf. ex Fisch., C.A.Mey. & Avé-Lall. | Apiaceae         | Golpar       | Fruits and leaves           | East Khuzestan (21) | 1-Octanol                          | C₈H₁₈O            |
| *Achillea millefolium* L.            | Asteraceae       | Boomadaran    | Flowering branch            | East Khuzestan (21) | Borneol                            | C₈H₁₈O            |
| *Anthemis cotula* L.                 | Asteraceae       | Babouneh bahareh | Flowering branch             | East Khuzestan (21) | N-Nonadecane                       | C₉H₁₈O            |
| *Biebersteinia multifida* DC.        | *Biebersteiniae*  | Bahmanpish    | Fruits                      | East Khuzestan (21) | Vasicinone                          | C₈H₈N₃O₃          |
| *Phlomis olivieri* Benth.            | Lamiaceae        | Balegoush     | Flower                      | East Khuzestan (21) | Germacrene D                       | C₈H₈O            |
| *Fritillaria imperialis* L.          | Liliaceae        | Laleh vazhgoun | Fruits and Bulb              | East Khuzestan (21) | 3-Methyl-2-buten-1-thiol            | C₈H₁₈O            |
| *Trifolium pratense* L.              | Papilionaceae    | Babouneh bahareh | Flower, leaves             | East Khuzestan (21) | Scopoletin                         | C₈H₈O            |
| *Plantago lanceolata* L.             | Plantaginaceae   | Kardeh       | Leaves                      | East Khuzestan (21) | Acteoside                          | C₈H₈O            |
| *Eremostachys laciniata* (L.) Bunge  | Lamiaceae        | Chele daghi   | Root                        | Ahar and Arasbaran (22) | Dodecanol                        | C₈H₁₈O            |
| *Thymus kotschyanus* Boiss. & Hohen. | Lamiaceae        | Avishan       | Flowering branch            | Abadeh Fars (23)    | Thymol                             | C₈H₁₈O            |
| *Nigella sativa* L.                  | Caryophyllaceae  | Siah daneh    | Seeds                       | Behbahan (24)       | Trans-Anethole oxide               | C₈H₁₈O            |
| *Astragalus adsendens* Boiss. & Hausskn. | Fabaceae.      | Gavan         | Root                        | Behbahan (24)       | Phenol                             | C₈H₁₈O            |
| *Rabus anatolicus* Focke             | Rosaceae         | Tamesk derakhtí | Aerial organs             | Behbahan (24)       | Phenol                             | C₈H₁₈O            |
| *Achillea eriophora* DC.             | Asteraceae       | Boumadaran    | Aerial organs               | Chaharbagh Golestan (26) | Cineole                        | C₈H₁₈O            |
| *Plantago lanceolata* L.             | Plantaginaceae   | Barhang sarneyzei | Seed and leaves             | Chaharbagh Golestan (26) | Cineole                        | C₈H₁₈O            |
| *Mentha longifolia*                   | Lamiaceae        | Poutinek      | Aerial organs, root         | Chaharbagh Golestan (26) | Cineole                        | C₈H₁₈O            |
| *Rosa canina* L.                     | Rosaceae         | Noghtebandi   | Fruit, flower and root      | Zanjan (27)         | Linoleic acid                      | C₈H₁₈O            |
| *Ziziphora tenuior* L.               | Lamiaceae        | Gavehzang     | Root                        | Zanjan (27)         | Phenol                             | C₈H₁₈O            |
| *Achillea millefolium* L.            | Asteraceae       | Boumadaran    | Flowering branch            | Sajasrood (28)      | Borneol                            | C₈H₁₈O            |
| *Ziziphora clinopodioides* L.        | Lamiaceae        | kakouti       | Aerial organs               | Sajasrood (28)      | Pulgon                             | C₈H₁₈O            |
| *Anethum graveolens* L.              | Apiaceae         | Shevid        | Seeds                       | Sirjan Kerman (29)  | Alpha-Phellandrene                 | C₈H₁₈O            |
| *Coriandrum sativum* L.              | Apiaceae         | Geshniz       | Stem, leaves and seeds      | East Persian Gulf (30) | Alpha-Pinene                      | C₈H₁₈O            |
| *Artemisia scoparia* Waldst. & Kit.   | Asteraceae       | Dermane sharghi | Leaves                     | East Persian Gulf (30) | Absinthin                         | C₈H₁₈O            |
| *Punica granatum* L.                 | Punicaceae       | Anar          | Fruits                      | East Persian Gulf (30) | 3,3′-Di-O-Methyllellagic acid     | C₈H₁₈O            |
| *Foeniculum vulgare* Miller.         | Apiaceae         | Razianeh      | Fruits, branch and leaves   | North Khuzestan (31) | Phenol                             | C₈H₁₈O            |
| *Heracleum persicum* Desf. ex Fischer. | Apiaceae       | Golpar        | Fruits, Leaves              | North Khuzestan (31) | Octyl acetate                      | C₈H₁₈O            |
| Scientific name                     | Herbal family | Persian name       | Used organ        | Region                        | Main compound                  | Chemical formula |
|------------------------------------|---------------|--------------------|-------------------|-------------------------------|--------------------------------|-------------------|
| *Prangus ferulacea*                | Apiaceae      | Jashir             | Flower, Leaves    | North Khuzestan (31)          | Alpha-Pinene                 | C_{10}H_{16}O    |
| *Achillea millefolium* L.          | Asteraceae    | Berenjasef         | Flowering branch  | North Khuzestan (31)          | Borneol                      | C_{10}H_{16}O_2  |
| *Anthemis cotula* L.               | Asteraceae    | Babouneh bahareh   | Flowering branch  | North Khuzestan (31)          | N-Nonadecane                 | C_{10}H_{16}O_2  |
| *Biebersteinia multifida* DC.      | Biebersteiniaceae | Boumadou          | Leaves            | North Khuzestan (31)          | Alpha-Pinene                 | C_{10}H_{16}O_2  |
| *Achillea wilhelmsii* C. Koch      | Asteraceae    | Shabdar            | Flowers, Seeds    | North Khuzestan (31)          | Pulegone                      | C_{7}H_{11}O_3   |
| *Anethum graveolens* L.            | Apiaceae      | Shevid             | Leaves, seeds     | Marivan (34)                  | Alpha-Phellandrene            | C_{10}H_{16}O_2  |
| *Hypericum perforatum* L.          | Fumariaceae   | Shifaringhi        | Aerial organs     | Marivan (34)                  | Hypericin                     | C_{10}H_{16}O_2  |
| *Merhitina longifolia* L.          | Lamiaceae     | Shifaringhi        | Flowering branch  | Marivan (34)                  | Pulegone                      | C_{7}H_{11}O_3   |
| *Achillea wilhelmsii* C. Koch      | Asteraceae:   | Shifaringhi        | Aerial organs     | Natanz Kashan (35)            | Camphor                       | C_{10}H_{16}O_2  |
| *Lounacca acanthodes* (Boiss.) O Kuntze, Revis. | Asteraceae | Shifaringhi        | Flowers, Leaves   | Natanz Kashan (35)            | Dodecanal                     | C_{10}H_{16}O_2  |
| *Ajuga chamecistus* Ging, Ex Benth. | Lamiaceae     | Shifaringhi        | Flowers, Leaves   | Natanz Kashan (35)            | Geraniol                      | C_{10}H_{16}O_2  |
| *Galionia bruguieri* A. Rich.      | Rubiaceae     | Shifaringhi        | Flowers, Leaves   | Natanz Kashan (35)            | Artemetin                     | C_{10}H_{16}O_2  |
are characterized by a richness of various medicinal plants and native flora species due to suitable physiographic and continental conditions. These plants have been used by Iranians for thousands of years. Overall, ethnobotanical knowledge about medicinal plants in Iran has a remarkable impact on the study and documentation of important information about them.

Anethole is a monomethoxybenzene, which is methoxybenzene substituted in which it has a role as a plant metabolite (36). Borneol is a natural insect repellent (37). It has been shown that vasicinone has an anti-anaphylactic action (38). Thymol can be used as a disinfectant (39). Camphor is used to make moth-proofing products, pharmaceuticals, and flavorings (36). Eucalyptol (cineol) is an ingredient in commercial mouthwashes, and has been used in traditional medicine as a cough suppressant, an insecticide, and an insect repellent (40). α-Pinene is an anti-inflammatory agent acting via PGE1. Moreover, it is an antimicrobial agent and a positive modulator of GABA receptors (41-43). Absinthin shows biological activity and has proved to be a promising anti-inflammatory agent (44). Carvacrol has antimicrobial activity against different bacteria (45). Linalool is used as a flea, fruit fly, and cockroach insecticide (46). Furthermore, it is used in some mosquito-repellent products (47). Hypericin is an antioxidant and antimicrobial compound (48). Geraniol is used as an insect repellent, particularly for mosquitoes (49). Phenols are versatile precursors to an extensive collection of drugs, most notably aspirin, though it is also a precursor to many herbicides and pharmaceutical drugs (50). It is worth noting that antioxidants vary widely in their free-radical quenching effects, and each might be individually attracted to specific cell sites (51). The herbs in this study contain phenolic and antioxidant compounds with extensive medicinal properties such as antimicrobial, anti-parasitic, anti-inflammatory, and analgesic activities. They can treat many disorders and diseases, including digestive problems such as heartburn, or treat their side effects.

In different parts of Iran, various medicinal plants are used to treat gastrointestinal diseases that cause heartburn symptoms and nausea. Kerman's traditional knowledge confirms the use of L. cyminum to treat bloating and colitis (25). In the Arasbaran region of Iran, Berberis vulgaris is used for gastrointestinal problems, Origanum vulgare as a stomach tonic, and Heracleum persicum for digestive problems (22). In Sistan's ethnic botany, Cumin (Cuminum cyminum L.) is used as a painkiller and stomach tonic (37). Traditional knowledge of Shiraz approves the use of Althea aucteri Boiss to treat digestive disorders (33). In Kazerun, Anethum graveolens L. and Anthemis austro-iranica are used to overcome cold symptoms. Moreover, Cichorium intybus is used to strengthen the stomach, and the use of Mentha longifolia is recommended to reduce bloating and stomach acid. Finally, Teucrium polium L. is used to eliminate bloating, and Alcea aucteri is considered a laxative (33). In Mobarakeh, Isfahan, Chamomilla recutita L., Cumin (Cuminum cyminum L.) and Mentha pulegium L. are used to treat diarrhea and strengthen the stomach. Cichorium intybus L. is used to treat constipation (53). In the traditional knowledge of Ilam, Anthemis altissima is used as a food digester, and Cichorium intybus L. is utilized as both a laxative and a reliever of stomach pain (54).

Ethnobotanical studies identify medicinal plants' use as a valuable way to identify efficient medicinal plants (55). Medicinal plants have nutritional and health value, and their useful compounds can be beneficial sources of medicine for the treatment of various disorders (56,57). It has been indicated that some of the herbs whose beneficial effects on heartburn were reported in this study or previous studies are efficient against diarrhea, stomach pain, and indigestion. Moreover, they have common therapeutic effects with our reported ethnobotanical effects.

Over the past few decades, the study of indigenous pharmacopoeia's knowledge or the traditional use of herbal medicines with the prospect of producing new medication has been on the agenda of many national and international organizations. The positive approach of scientists and the increasing tendency of governments to cooperate in ethnobotanical projects indicate the growing value of the information obtained from these studies. The medicinal plants mentioned above have been traditionally used to treat heartburn.

Conclusion
Many plants reported in this study contain bioactive compounds, including flavonoids tannins and anthocyanins with antioxidant activities, which are effective in heartburn. Therefore, the results of this study can be highly significant and pave the way for the preparation of natural medicines effective on heartburn.

Authors' contributions
GHB, PGH, MH reviewed and contributed to data collection and preparation of the manuscript. The first draft was prepared by PGH, MH, PAB. All authors read the final version and confirmed it for publication.

Conflict of interests
The authors declared no competing interests.

Ethical considerations
Ethical issues (including plagiarism, data fabrication, double publication and etc.) have been completely observed by the authors.

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