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Shigellosis phytotherapy: A review of the most important native medicinal plants in Iran effective on Shigella

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ABSTRACT

Shigella is a gram-negative intracellular pathogen which causes bacillus diarrhea in humans. Besides clinical and gastrointestinal diseases, shigella causes food poisoning. In Iran, medicinal plants are used to treat infectious diseases. In this review article, the native medicinal plants to Iran that are effective on shigellosis were reported. For this purpose the key words Shigella, medicinal plants, essence, and extract were searched for in databases such as Scientific Information Database, Scopus, PubMed, Magiran, and Google Scholar and the related articles were retrieved and analyzed. Findings indicated that 18 medicinal plants native to Iran were effective on shigellosis, including Echinophora cinerea Boiss, Echinophora cinerea Boiss, Stachys lavandulifolia Vahl, Cuminum cyminum, Alliums stadium, Cymbopogon olivieri (Boiss), Salvia suffruticosa, Achillea wilhelmsii, Cleome iberica, Centaurea depressa, Teucrium polium L., Salvia mirzayanii, Haplophyllum canaliculatum, Geum coccineum, Mentha spicata L., Saliva aethiopis L., Salvia atropatana Bunge, Salvia oligophylla Auch. Ex Benth., Salvia macrosiphon Boiss. Identification of effective components of these plants could be a route to producing nature-based antibiotics for shigellosis.

Key words: Shigella, Medicinal plants, Iran

INTRODUCTION

Infectious and non-infectious diseases are day by day increasing in prevalence [1-10]. Epidemiological studies have highlighted detection of disease course and strategies of disease prevention and management [11-28]. Infectious diseases are an important issue of the twenty-first century and medicine [29]. Shigella is a gram-negative intracellular pathogen which causes bacillus diarrhea in humans. Different species of Shigella bacteria are transmitted through fecal-oral route and enter into human body via contaminated food and water. For shigella, about 10-100 organisms are sufficient to cause infection [30]. Colon biopsies from infected patients have shown extensive infiltration of inflammatory cells, tissue edema, and certain areas of epithelium which have been completely destroyed. Shigella is able to invade epithelial cells to gain entry to the epithelium of the colon and exploitation of the specialized epithelial cells in lymphoid follicles. Gastrointestinal disorders and diarrhea are also caused by this pathogenesis [31-34]. Besides clinical and gastrointestinal diseases, Shigella may cause food poisoning as the third leading reason for food poisoning after Salmonella and staphylococcus [35].

Table1. Native medicinal plants native to Iran effective on Shigella

Row	Scientific name	Family	Persian name	Main findings
1	*EchinophoracinereaBoiss*	Apiaceae	Khosharizeh	An experimental study indicated that *Echinophora cinerea* Boiss. essence on *S. dysenteriae* formed a growth inhibition zone of 15 mm [64].
2	*StachyslavandulifoliaVahl*	Lamiaceae	Chaye kouhi	An experimental study indicated that *Stachys lavandulia* Vahl. essence on *S. dysenteriae* formed a growth inhibition zone of 29.6±0.3 mm [64].
3	*Cuminum cyminum*	Apiaceae	Zireyeh sabz	A study indicated that *Cuminum cyminum* essence on *Shigella flaxneri* formed a growth inhibition zone of 23 mm (64). Also, MIC* and MBC** were obtained 1.48 and 1.24, respectively [65].
4	*Alliums stadium*	Liliaceae	Sir	A study indicated that MIC and MBC of *Alliums stadium* for *S. dysenteriae* was obtained 12.5 and 25 mg/dL, respectively [66].
5	*Cymbopogonolivieri*	Graminaceae	Poutar	A study indicated that *Cymbopogon olivieri* extract on *S. flaxneri* formed a growth inhibition zone of 16 mm [67].
6	*Salviasuffruticosa*	Lamiaceae	Maryamgoli maemouli	A study indicated that ***Salvia suffrucotisa*** extract on *S. flaxneri* formed a growth inhibition zone of 16 mm [67].
7	*Achilleawilhelmsii*	Asteraceae	Boumadaran	A study indicated that ***Achillea wilhelmsii*** extract on *S. flaxneri* formed a growth inhibition zone of 19 mm [67].
8	*Cleomeiberica*	Cleomaceae	Golegandome chamanzar	A study indicated that ***Cleome iberica*** extract on *S. flaxneri* formed a growth inhibition zone of 10 mm [67].
9	*Centaurea depressa*	Lamiaceae	Golegandom	A study indicated that *Centaurea depressa* extract on *S. flaxneri* formed a growth inhibition zone of 15 mm [67].
10	*Teucrium polium L.*	Lamiaceae	Kalpoureh	An experimental study indicated that *Teucrium polium* L. essence on *S. flaxneri* formed a growth inhibition zone of 23 mm [68].
11	*Salvia mirzayanii*	Lamiaceae	Mourtalkh	An experimental study indicated that 20, 10, 5, 2.5, 1.25, and 0.625 mg *Salvia mirzayanii* essence formed a growth inhibition zone of 17.67, 13.33, 12, 10, 9, and 8 mm, respectively [69].
12	*Haplophyllum canaliculatum*	Rutaceae	Sodabe tarkei	An experimental study indicated that 20, 10, 5, 2.5, 1.25, and 0.625 mg *Haplophyllum canaliculatum* essence formed a growth inhibition zone of 17.33, 17, 14.67, 12.67, 11.33, and 9.67 mm, respectively [69].
13	*Geumkokanicum*	Rosaceae	Mikhake kouhi	An experimental study indicated that 10 mg *Geum coccaneum* fraction disk on Shigella formed a growth inhibition zone of 20 mm [70].
14	*Menthaspicata*L.	Lamiaceae	Naenaeye sabz	A study indicated that MIC and MBC of *Mentha spicata* L. for *S. flaxneri* was obtained 0.156 and 0.364±023, respectively [71].
15	*SalivaaethiopisL.*	Lamiaceae	A type of Golegandome	An experimental study indicated that S. aet 3% extract on *S. flaxneri* formed a growth inhibition zone of 1±0 mm [72].
16	*Saliva atropartana Bunge*	Lamiaceae	A type of Golegandome	An experimental study indicated that S. *atropartana* 3% extract on *S. flaxneri* formed a growth inhibition zone of 5±0 mm [72].
17	Saliva oligiphylla Auch. *exBenth.*	Lamiaceae	A type of Golegandome	An experimental study indicated that S. oligiphylla 3% extract on *S. flaxneri* formed a growth inhibition zone of 10±0.3 mm [72].
18	Saliva macrosipohn BOISS	Lamiaceae	A type of Golegandome	An experimental study indicated that S. macrosipohn 3% extract on *S. flaxneri* formed a growth inhibition zone of 15.3±0.3 mm [72].

** Minimum inhibitory concentration*
*** Minimum bactericide concentration*

Medicinal plants are botanically considered important because of containing pharmaceutically and nutritionally active components. Excessive use of antibiotics has often led to growing bacterial resistance to these drugs. On the other hand, excessive use of antibiotics leads frequently to side effects in human body [36]. Irrespective of their main effective substance, the significance of medicinal plants is related to containing other substances with therapeutic effects that can prevent the side effects-related toxicity in addition to strengthening the plant's therapeutic effect [37]. Further, being nature-based and causing fewer side effects than chemical drugs have resulted in growing use of medicinal plants [37]. A recent concern in medicine and pharmacology is bacterial resistance, which has been reported over 90% to some chemical drugs [38]. The related problems have caused great interest in searching for and suggesting antimicrobial compositions particularly plant-based ones [39,40]. Plant-based compositions are traditionally used to treat a variety of infectious and non-infectious diseases in many regions worldwide [41-63]. Shigellosis is a significant infectious disease. In Iran, medicinal plants are used to treat infectious diseases. In this review article, the native medicinal plants to Iran that are effective on shigellosis are reported.

In this study, the key words Shigella, medicinal plants, essence, and extract were searched for in databases such as Scientific Information Database, Scopus, PubMed, Magiran, and Google Scholar and the related articles were retrieved and analyzed.

Analysis of various publications indicated that 18 medicinal plants native to Iran were effective on shigellosis, including *Echinophora cinerea* Boiss, *Echinophora cinerea* Boiss, *Stachys lavandulifolia* Vahl, *Cuminum cyminum*, *Alliums stadium*, *Cymbopogon olivieri* (Boiss), *Salvia suffruticosa*, *Achillea wilhelmsii*, *Cleomei berica*, *Centaurea depressa*, *Teucrium polium* L., *Salvia mirzayanii*, *Haplophyllum canaliculatum*, *Geum coccineum*, *Mentha spicata* L., *Saliva aethiopis* L., *Salvia atropatana* Bunge, *Salvia oligophylla* Auch. exBenth., *Salvia macrosiphon* Boiss (Table 1).

DISCUSSION

The findings of the present study indicated that *E. cinerea*, *S. lavandulifolia*, *C. cyminum*, *A. stadium*, *C. olivieri*, *S. suffruticosa*, *A. wilhelmsii*, *C. iberica*, *C. depressa*, *T. polium* L., *S. mirzayanii*, *H. canaliculatum*, *G. coccineum*, *M. spicata*, *S. aethiopis*, *S. atropatana*, *S. oligophylla*, *S. macrosiphon* were anti-shigellosis.

Phytochemical analysis of anti-shigellosis plants has indicated that the above plants have effective components. In traditional medicine, *S. lavandulifolia* is used to relieve pain particularly joint and rheumatic pain, headache, dizziness, and neurological pains [73]. *S. lavandulifolia* contains mircin, digimarcin, beta-pinene, alpha-pinene. In traditional medicine, *E. cinerea* is used to strengthen stomach [74,75].

Alpha-phellandrene, carvacrol and alpha-pinene are the main components of *E. cinerea* [76]. *C. cyminum* is used to treat gastrointestinal tract diseases as carminative and digestion-facilitative and pulmonary diseases and cough [77]. The main components of *C. cyminum* include sabinene, flavonoids, polysaccharides, couminaldehyde, pinene, and terpinene [78]. In traditional medicine anti-convulsive, anti-inflammatory, analgesic, refrigerant, and wound-healing properties of *T. polium* have been confirmed [79]. Saliva is used to treat common cold, bronchitis, gastrointestinal disorders, and brucellosis [80].

Different species of Saliva genus contain flavonoids, diterpenoids, and sesterpenes [81-84]. *H. canaliculatum* components include 7-isopentenyloxy-γ-fagarine, perfamine, flindersin, skimmianine, and atanine [85]. In medicine *G. coccineum* is used to treat diarrhea, gastrointestinal disorders, and acid reflux as well as for dyeing [86].

Eugenol and mirtenol are main effective substances of *G. coccineum* essence [87]. In traditional medicine, *M. spicata* has been abundantly used to digest foods further, increase gastrointestinal tract movements, treat common cold and cholera, and relieve bronchial inflammation [88-94].

Phenolic compounds including flavonoids and flavonols have strong antimicrobial activities [86]. Hence, the antimicrobial activity of this plant might be, at least in part through phenolic compounds. It should be noted that there are a lot of other plants which have phenolic compounds [95-112], which worth examining. These compounds have antioxidant properties [113-122] which reduce the infection side effects.

Currently in case a drug resistance is developed, the drug is changed to fight pathogenic bacteria and fungi. In light of traditional therapeutic effects and chemical analysis of the above plants, their effective substances could be examined in experimental and clinical investigations and if their positive effects are demonstrated, they can be used to produce nature-based antibiotics effective on Shigella.

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