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Antimicrobial and Antifungal Activity of Herbs and their Active Ingredients

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Abstract

Introduction:
Herbal plants have been used in traditional medicine from ancient times. This paper aims to explore the antimicrobial effects of various medicinal plants on the bacteria.
Methods:
In this review a comprehensive literature review was performed on papers that have been published from 2004 till 2016with special focus on those that have been reported native medicinal plants in Iran.
Result:
The reported MIC and MBC indices for the mentioned plants against *bacterial* were. As it can be found majority of studied plants had bacteriostatic activity and some of had both bacteriostatic and as well as bactericidal activity.
Discussion
This study explored the effects of many medicinal plants on bacteria. These effects might be used for formulating drugs to be used for treating infective diseases.

Keywords: pathogenic bacteria, plant extracts, medicinal plants.

Introduction

Medicinal plants have always been used throughout human history. These plants were the only available source of drug used for treating diseases. Despite the recent developments of synthetic medicine, medicinal plants are still being used in a wide scope. Due to its natural diversity and vast fields, Iran has a wide range of medicinal plants which form the basis of traditional medicine. Plant medicines have been introduced as sound substitutes for synthetic plants. One of the problems caused by antibiotics consumption is the emergence of bacteria-resistant antibiotics.

Method

In this review a comprehensive literature review was performed on papers that have been published from 2004 till 2016with special focus on those that have been reported native medicinal plants in Iran. For this purpose, the most related data resources such as NCBI, Sciencedirect, Springer, Web of science and as well as local databases such as Irandoc, Islamic science citation (ISC) and Magiran were searched for desired papers.

Results

The reported MIC and MBC indices for the mentioned plants against *bacterial infections* were detected. As it can be found majority of studied plants had bacteriostatic activity and some of had both bacteriostatic and as well as bactericidal activity.

Discussion

Antibacterial activity of *Marrubium vulgare*:

M. vulgare is a perennial herb of the family of mint, originated from those Mediterranean regions. This plant is widely spread in the Montenegro and HerzGuin mountains in the former Yugoslavia. Different species of this plant grow in a wide range of different parts of Iran such as the Alborz slopes, the western regions and also in the northern Khorasan. But the main species, known in the world as medicinal herb, is not native to Iran and is cultivated in Iran for agricultural production and cultivated in Tehran, Qazvin, Mazandaran, Gilan and Khorasan provinces.

The part used in this plant is in the pharmaceutical industry, its leaves and flower branches are arranged in the spring or autumn. The leaf of the herb contains essential oil of tannin, and a bitter substance. 50% of the essential oil is called a pillar called throne, also called Salvillus, Salvion, Salvon. Also, the essential oil of the herb contains some other substances such as pinene, cineol and boronol.

Bekaiyan et al. investigated the antimicrobial activity of the sage, the results showed that Essential Oil and Salvia extract of *Staphylococcus aureus*. The lowest inhibitory concentration of Salvia extract is 2.5 mg / ml and the highest inhibitory concentration of essential oil is 2.5 mg / ml (1)

Khanavi showed that the major component of *M. vulgare* from other region of Iran were _-bisabolene (25.4%), β- caryophyllene (11.6%), germacrene D (9.7%) and E-Bfarnesene (8.3%) (2). The in vitro antibacterial activity of essential oil of *M.vulgare's l*eave showed a significant activity against microorganisms, especially Gram positive bacteria with inhibition zones and MIC values in the range of 6.6-25.2 mm and 1120-2600 µg/mL, respectively(3).
Atay et al., explored the antifungal effects of plant extracts, cinnamon, turmeric, lemonade, mint, peppermint, springtime, on *Candida albicans* are compared with nystatin mouthwash. The results of this study showed that the extracts of turmeric, Eucalyptus, Acsentin, Cinnamon, Maryam Goli, Mint, Onion, Spring always have antifungal effect. This property is stronger and more significant in the first four plants (49).

In the study of Tavakoli Poor et al, pistachio peppermints with sage extract in amounts of 3500, 4500 and 5000 ppm and cumin in 3000, 5000, 5500, 6000 and 6500 ppm were added to the coating and in addition the control sample was also in The control group consisted of pistachio nuts without ointment and without pistachio extract and pistachio nuts, without extracts. Then, the treatment and control groups were inseminated in sterile plates to investigate the antifungal effects in the real model, and the seven-day culture of *Aspergillus flavus* was inoculated into the geometric center of the plates, and then measured in the form of daily growth of the inoculum disc. The results are presented in the form of poison control measurement charts B1, B2, G1 and G2. The results showed that concentrations of more than 6000 ppm for the extracts of seaweed were higher than 4500 ppm and prevented the production of aflatoxin in the pistachio brain (48).

Pozati et al. explored the effect of several plant extracts, including herb on the *Candida albicans.*

Resistant and susceptible to fluconazole, in which the results showed that sage did not have antifungal activity against Candida (26)(In another study, MIC of 5% and 90% of the squirrel was suppressed by Candida albicans above 320 µg / ml, which made it ineffective (27)..

Antibacterial activity of *Peganum harmal:*

Peganum harmala is a family of Nitrariaceae, a native to the semi-arid and driest regions of the Northwest of India, South Africa, Central Asia, the Iranian-Turanian, Samara-Sandy, Mediterranean and Europe-Siberian arenas. Esfand has been used as an antiseptic since ancient times in Iran(28, 29), as well as in March for the treatment of back pain, asthma, colic, and jaundice. (30). Esfand's extract contains flavonoid antimicrobial agents and beta-carboline alkaloids (Harmonium-Harmalins-Harmonol, Peganin and Kinazolin) that are found mostly in roots, seeds and calluses of the plant (31). Esfand also has the ability to kill algae, bacteria, intestinal parasites and fungi (32).
The study of Shiri, The results show *P. harmal* and *M. comminus* L. were a potent antimicrobial activity against Gram-positive (*Staphylococcus aureus*) and

Gram-negative (*Escherichia coli* and *Enterobacter cloacae*) bacteria respectively. Moreover, all 6 plants extracts showed relatively same antibacterial activity against Gram-positive (*Staphylococcus saprophyticus* and *S. aureus*) and *S. Montana* extracts showed relatively same antibacterial activity against all Gram-negative bacteria and *Morganella morgani* was the more resistant bacteria for all plants extracts(4).The study of Javadian, was to investigate the antimicrobial activity of an extract of the *Peganum harmala* flower and *Heracleum persicum* against *Acinetobacter baumannii*. The levels of MIC extract and essential oil of *P.harmala* were observed in ranges from 6.25 ppm to 12.5 ppm and 3.1 ppm to 25 ppm, respectively. The highest MIC value was observed as 12.5 ppm in *A. baumannii*. The levels of MIC extract and essential oil of *H. persicum* were observed in ranges from 5 ppm to 20 ppm and 12.5 ppm to 10 ppm, respectively. The highest level of MIC extract and the highest essential oil value of *H.persicum*were observed as 20 ppm and 10 ppm, respectively, in *A. baumannii*.(5)

Antibacterial activity of *Capsium annuum:*

Pepper is herbaceous and has a peppery stem that is from peppery dark. Some of the extracted antimicrobial compounds include: thrupin, beta-pinene, alpha-pinene, linalol, and terpineol, their medicinal properties include anti-contraceptive, antiseptic, antibacterial, fever and laxatives (33, 34).
The study of Bokaeian, , the antibacterial and anti-biofilm activities of extract *Capsicum annuum* L were examined. The results show that the concentrations of 5 and 10 mg/mL are the most restrain in the biofilm formation of the isolated plates (6).

In the study of Careaga, the results showed that the minimum inhibitory extract concentration of Capsicum annum against growth of *Salmonella. typhimurium* in minced beef was 1.5 mL/100 g of meat; the addition of 1%, 2%, 3% and 4% w/w of sodium chloride did not have any additional inhibitory effect on *Salmonella* (7).

The result of de Marino et al. show that four new acyclic diterpene glycosides named capsianosides (8).
The study of Koffi-Nevry et al., showed the effect of *Capsicum annuum*and *Capsicum frutescens* methanol and aqueous extracts on selected bacteria (S. *aureus, Salmonella typhimurium, Vibrio cholerae, P. aeruginosa, E. coli*, and *Shigella dysenteriae*) were investigated that result show both extracts were found to be effective against *Vibrio cholerae, S. aureus,* and *Salmonella typhimurium*, while methanol extracts showed the greatest effect (9).

Antibacterial activity of *Cyminum cuminum*:

Cumin cuminum cyminum is a family of chutrians that has been used as an antispasmodic medicine since ancient times, due to the presence of various amounts of cumin aldehyde, limonene, paracymon, betaine, trinchin and Karoon is present in them (35).

In the study of Sancholyet al., A comparative study was performed on the antifungal effects of essential oils of Shariatian, Cumin and Indian Celery in comparison with formalin on aflatoxin producing fungi. The results showed that *Aspergillus parasiticus* The highest and lowest growth holes for the concentration of 125 µL / L after 8 days incubation were for formalin and Indian clove, respectively, with 62.8 and 14.1 mm, respectively. Indian clove and cumin (250 µL / L) and Shirjani and formalin (500 µL / L) were able to completely inhibit *Aspergillus parasiticus* growth (36).

In another study, essential oils of green, cacti and black cumin have an appropriate antifungal effect against *Aspergillus fumigatus* and *Aspergillus flavus,* and can be used for medical, pharmaceutical, veterinary, food, aromatics, and cosmetic applications. Hygiene is a form of medicine and antifungal agents (37).

In vitro study, the effect of cumin essential oil on *Fusarium urticuloiditis* fungi isolated from Iran was determined by microdilution method.

The highest frequency of MIC (minimum inhibitory concentration) was detected at a concentration of 0.055 g / ml and 42.84% isolates, and the lowest frequency was detected at a concentration of 293.0 g / ml with 7.7% isolates. In the MFC test, the highest frequency was observed in the concentration of 0.39 g / ml with 42.84% and the lowest frequency was found at 0.16, 0.293 and 0.586 g / ml with 14.4% . The MICs of different isolates of cumin essential oil were 0.079-0.39 g / ml and MFC values were 0.041 ± 1.787 g / ml. The effect of essential oil on the alteration of the fungus was also confirmed by microscopy. The results of this study indicated the effectiveness of this essential oil in inhibiting the growth of *Fusarium verticillioids* (38).

The another study, essential oil of *C. cuminum* was biofilm- formation preventive properties , is found against *streptococcus mutans* and *Streptococcus pyogenes*(10).

The study of Derakshan, the essential oil of *C. cuminum* decreased biofilm formation (11). *C. cyminum*oil exhibited stronger antimicrobial activity against *E. coli*, *S. aureus* and *L. monocytogenes*.

The study of Hosseini Jazani, Cumin essential oils possessed antibacterial effect against all isolates of *Pseudomonas aeruginosa*, with MIC and MBC values in the range of 0.015 to 0.25 ml/ml-1 (12).

The study of Bokaeian, antibacterial effects of *C. cyminum* Linn. Essential oil against multidrug resistant (MDR) *E. coli* strains isolated from urinary tract infections were studied, using microdilution method All of *E. coli* isolates were resistant to four of the antibiotics including ceftazidime (50%), cefixime (41.6%), tetracycline (75%) and erythromycin (58.3%). The highest MIC value (250 ppm) was observed against two antibiotics and the lowest (10 ppm) against one antibiotic (13).

Antibacterial activity of *Zataria multiflora Boiss*:

The thyme is in the Lamiaceae family. The most effective antimicrobial combination is thymol and caracrole (39).

This plant grows in Iran, Pakistan, India and Afghanistan. Dried leaves of the plant are used in the food industry.

It is used as a preservative and also due to its optimum taste (40)

Thyme extract Shiraz limits the inherent immunity (41)
And the front Growth of some microorganisms, such as fungi and bacteria.

The study of Motevasel, theresults showed it inhibited the growth of *S. epidermidis*, *S. saprophyticus* and methicillin sensitive *S. aureus* (MSSA) by about 8-16 µg/mL (14).

Antibacterial activity of *Myrtus communis*:

The plant is Myrtle (*Myrtus communis*, Myrtaceae), which has anti-bacterial, antifungal, anti-inflammatory and anti-inflammatory properties and is very effective in controlling diseases such as diabetes mellitus, pulmonary diseases, and cancers. The title is also an antioxidant. This plant has bacteriostatic properties and has higher bactericidal effects at higher concentrations (42).

The occurrence of antibacterial activity against specific pathogen bacteria of human diseases in leaf extract of *M.communis* was previously reported by Rotstein et al. (15), Mansouri et al. (16).Yadegarinia et al.,(17) have demonstrated the activity of *M. communis* L. essential oil against *E. coli*, *S. aureus* and *Candida albicans.*

Antibacterial activity of *Trachyspermum ammi:*

Carivcopticum is a plant of the Apiaceae family and is one of the most advanced primrose, herbaceous, annual, stingy, standing stems, 30 to 100 cm high, leaves with jaggings, large cuts Thin, white flowers with umbrella widths 0.2-0.3 mm, upper leaves of the stem, small umbellifs with little or more drooping daisies, often 6 to 8 drops. The petals are white and on the back surface along the flaky middle vein, deeply chopped tip, with the back end. The small, elliptical, yellowish-brown, odor-like thymol. The part used is the plant's fruit. Based on chromosomal data, it was found that n2 in this plant is 18.

The study of Kaure showed that ambint water, hot water and boiling water extract of ajowan revealed an antibacterial activity against *Entrococcus faecalis* and *Staphylococcus aureus* (18). The study of Malekinejad, the result show that *T. copticum* essential oil also showed antibacterial effects with rather high MIC values of 1.25 mg/ml (19).

Antibacterial activity of *Hibiscus sabdariffa:*

Sour Tea or Mecca Tea with the name of the science of *Hibiscus sabdriffa* from the Malvaceae family is a herbaceous, branched, greenish reddish green, and intermittent and clawed leaves with 3 to 7 lobes and margins of toothy leaves, glabrous, Large flowers with short stomach. The fruits are surrounded by meaty fillets containing 22 to 34 seeds per capsule. This plant has a straight, deep and penetrating root.

Its root is bitter and is used as antiseptic, augmentation, digestive nutrition, sexual enhancement and in the treatment of colds, coughs, fever, heart attacks, neurological diseases and cancer. It also

reduces the amount of alcohol absorption and reduces the severity of the effects of alcohol.

The study of Fullerton, the findings indicated that sorrel was effective at all levels in inhibiting *E. coli* O157:H7 (20).

Antibacterial activity of *Chamomillanobile:*

It was most effective against *S. aureus*, *S. mutans*, and *S.salivarius*; with also *Bacillus megatherium*, *Leptospira icterohaemorrhagiae*, and *Trichomonocidal* bactericidal activity (21).

Chamomile is one of the medicinal plants that contains various compounds including flavonoids, kemazolen and mucilaginous substances that produce a wide range of medicinal properties, including antifungal properties (43).

Also, Abubutain et al. (2011) stated that 96% chamomile ethanol extract not only has no inhibitory effects on Candida albicans, but also has stimulatory effects on the growth of this fungus, due to the presence of some nutrients in this plant (44).

Other studies also confirm the ineffectiveness of chamomile extract in inhibiting Candida albicans growth. In a study by Agarwal et al. In 2007, essential oil of chamomile showed no inhibition in various concentrations, and therefore lacked any inhibitory effect. Or a killer against *Candida albicans* (45).

In a study by Martinsa et al., in 2015, there was no clear growth halo around the disc containing alcoholic extract of 80% chamomile. As a result, the extract It did not have any effect on *Candida albicans* (46).

In 2016, acetonitrile and ethanolic extract of chamomile produced 13 and 14 mm chimney with no growth holes in comparison with the nystatin control group with 16 mm non-growth halo with significant antifungal effects against *Candida albicans* and 200 mg MIC Milliliters (47).

Antibacterial activity of *Mentha longifolia*

Mentha pipertia L. peppermint of the Lamiaceae family is one of the medicinal and medicinal herbs with its essential oil, medicine, food, makeup and sanitary . It is a hybrid that is derived from the cross between species (Mentha aquatic and Menthaspicata).

Bakht studied all extracts from *M. longifolia* showed different ranges of antimicrobial activities. Butanol and ethyl acetate fractions showed inhibitory activities against all microbial species. Methanol fraction showed inhibitory effects against all the tested microbial species except *Salmonella typhi*. It was also not controlled by methanol, petroleum ether and dichloromethane extracted samples. The most susceptible gram positive bacteria was *Bacillus atropheus* and *Bacillus subtilis* which were inhibited by all extracts and *Staphylococus aureus* was the least susceptible among gram positive bacteria. *K. pneumoniae* was the most susceptible gram negative bacterium and Salmonella typhi was highly resistant among the gram negative bacteria. *Erwinia carotovora* and *Agrobacterium tumefaciene* were susceptible to all fractions. All fractions showed antifungal activities against *Candida albicans* except water extracted samples (22).

Antibacterial activity of *Satureja hortensis*:

Herbal saffron is one year from the family of mint, herb and sometimes bush. This is a one-year-old, semi-hard-boiled, slightly bitter flavor that is like the Thyme flavor. The root of the root is direct, it has many branches. The leaves grow by 14 inches, with straight and narrow stems, with small, thin, linear (peach) brandy leaves, and without petioles, and may be shrunk in the margin. The length of the leaves is 1 to 2 cm and the width is 2 to 4 mm. From the arms of the leaves, the flowers are small and large purple or pink, and sometimes white in color with short dumbbells. The flowers are irregular, small and bisexual, and in the upper regions of the stems, they are observed in a cluster on multiple cycles. Each cycle has 1 to 5 goals. Flowers are tubular and generally have 4 whites and appear in the summer. In this plant, the stem is straight and square. The lower part has more branching. Summer herbs are used as herbal medicines, traditionally used as stimulant, anti-inflammatory, suppressor, stomach fluids, as well as anti-diarrhea and sexual enhancement and anti-infective.

the study of Adiguzel et al. explored the essential oil of *S.hortensis* exhibits activity against 25 bacteria, 8 fungi, and yeast, *C. albicans*; exerting the minimum inhibitory concentration values ranging from 15.62 to 250 µL/mL (23). In a more recent study, Sahin et al. have found that essential oil and methanol extract of *S.hortensis* show have a strong inhibitory effect on a wide range of bacteria and fungi (24). The results

obtained in the study of Razzaghi-Abyaneh et al. clearly showed a new biological activity for *S. hortensis* L. as strong inhibition of aflatoxin production by *A. parasiticus* (25).

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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Ethical Approval:

The result were collected from a experimental.

References

1. Bokaeian M, Saboori E, Saeidi S, Niazi A-A, Amini N, Khaje H, S Bazi. Phytochemical analysis, antibacterial activity of Marrubium vulgare L against Staphylococcus aureus in vitro. Zahedan J Res Med Sci (ZJRMS) 2014;
2. Khanavi M, Ghasemian L, HosseinyMotlagh E, et al. Chemical composition of the essential oils of MarrubiumparviflorumFisch. & C.A. Mey and Marrubium vulgare L. from Iran.FlavFragr J 2005; 20(3): 324-326.
3. Zarai Z, Kadri A, Ben-Chobba I, et al. The in-vitro evaluation of antibacterial, antifungal and cytotoxic properties of Marrubium vulgare L. essential oil grown in Tunisia. Lipids Health Dis 2011; 10: 161.
4: Shiri Y, Solouki M, Saeidi S. Activity of some Iranian plant extracts against multi-drug resistant human pathogens isolated from urinary tract infections. Zahedan J Res Med Sci (ZJRMS) 2014
5. Javadian F, Saeidi S and Jahani S. Antimicrobial Activity of Peganumharmala and Heracleumpersicum Against Acinetobacter baumannii. Int J Infect. 2016; 3(1): e33554.
6. Bokaeian M, Saeidi S, Bazi S, Ghamgosha M. The Effects of *Capsicum annuum*L Extract on the Control of Single and Dual Biofilms of Common Pathogenic Strains Causing Urinary Tract Infection . Zahedan Journal of Research in Medical Sciences**.** 2014.
7.Careaga M, Fernandez E, Dorantes L, et al. Antibacterial activity of Capsicum extract against *Salmonella typhimurium* and *Pseudomonas aeruginosa* inoculated in raw beef meat. Int J Food Microbiol 2003; 83(3): 331- 335.
8. de Marino SD, Borbone N, Gala F, et al. New constituents of sweet *Capsicum annuum*L. fruits and evaluation of their biological activity. J Agric Food Chem 2006; 54(20): 7508-7516.
9. Koffi-Nevry R, Kouassi KC, Nanga ZY, et al. Antibacterial activity of two bell pepper extracts: *Capsicum annuum* L. and *Capsicum frutescens*. Int J Food Properties 2012; 15(5): 961-971.
10.Shayegh S, Rasooli I, Taghizadeh M, AstanehSD.Phytotherapeutic inhibition of supragingival dental plaque. Nat Prod Res. 2008; 22: 428- 439
11.Derakhshan S, Sattari M, Bigdeli M. Effect of subinhibitory concentrations of cumin (*Cuminumcyminum* L) seed essential oil and alcoholic extract on the morphology, capsule expression and urease activity of *Klebsiellapneumoniae*.Int J Antimicrob Agents. 2008;32
12. Hosseini JazaniN, Zartoshti M, ShahabiS.Antibacterial Effect of Iranian Cuminumcyminum Essential Oil on Burn Isolates of Pseudomonas aeruginosa. International Journal of Pharmacology. 2008; 4(2): 157-159.
13.Bokaeian M; Shiri Y ; Bazi S ; Saeidi S; Sahi Z. Antibacterial activities of *Cuminumcyminum*Linn Essential Oil Against Multi-Drug resistant *Escherichia coli*. Int J Infect. 2014 June; 1(1): e18739.
14. Motevasel M, Okhovat MA, Zomorodian K, Farshad S.A Study of the Effect of Zataria multiflora Extract on Methicillin Resistant *Staphylococcus aureus*. Jundishapur Journal of Microbiology 2013; ; 6(5): e5453
15. Rotstein A, Lifshitz A, Kashman Y. Isolation and antibacterial Activity of Acylphloroglucinolsfrom *Myrtuscommunis*. Antimicrobial Agents and Chemotherapy . 1974; 6: 539-542
16.Mansouri S, Foroumadi A, ghanei T, Najar AG. Antibacterial activity of the crude extractsand fractionated constituents of

Myrtuscommunis.PharmaceuticalBiology . 2001; 39: 399-401
17. Yadegarinia D, Gachkar L, Rezaei MB, Taghizadeh M, Shakiba AA, Rasooli I. Biochemical activities of Iranian *Menthapiperita* L. and *Myrtuscommunis* L. Oils. Phytochemistry.2006; 67: 1249–1255.
18. Kaur, T., Bijarnia, R.K., Singla, S.K and Tandon, C.In vivo efficacy of *Trachyspermumammi* anti calcifying protein in urolithiatic rat model. J Ethnopharmacol, 2009; 126:459–462.
19. Malekinejad H, Bazargani-Gilani B, Tukmechi A and Ebrahimi H.A cytotoxicity and comparative antibacterial study on the effect of *ZatariamultifloraBoiss*, *Trachyspermumcopticum* essential oils, and Enrofloxacin on Aeromonashydrophila. Avicenna Journal of Phytomedicine . 2012; 2(4): 188-195.
20. Fullerton M, Khatiwada J, Johnson JU, Davis S and Williams LL. Determination of Antimicrobial Activity of Sorrel (*Hibiscus sabdariffa*) on *Esherichia coli* O157:H7 Isolated from Food, Veterinary, and Clinical Samples. J Med Food. 2011; 14(9): 950–956.
21. Cinco M, Banfi E, Tubaro A, and et al. A microbiological survey on the activity of a hydroalcoholic extract of *camomile*. Int J Drug Res 1983;21(4):145-151.
22. Bakht J, Shaheen S, Shafi M. Antimicrobial potentials of *Menthalongifolia* by disc diffusion method. Pak J Pharm Sci. 2014; 27(4): 939-45.
23. Adiguzel A, Ozer H, KiliC H, CetiN B. Screening of antimicrobial activity of essential oil and methanol extract of *Saturejahortensis* on foodborne bacteria and fungi. Czech J Food Sci. 2007;25(2):81.
24. Sahin F, Karaman I, Gulluce M, Ogutcu H, Sengul M, Adiguzel A, et al. Evaluation of antimicrobial activities of *Saturejahortensis* L. J Ethnopharmacol. 2003;87(1):61–5.
25. Razzaghi-Abyaneh M, Shams-Ghahfarokhi M, Yoshinari T, Rezaee MB, Jaimand K, Nagasawa H, et al. Inhibitory effects of *Saturejahortensis*L. essential oil on growth and aflatoxin production by Aspergillus parasiticus. Int J Food Microbiol. 2008;123(3):228–33.
26. Pozzatti P, Alvee L, Borba T, Linde M,Morais J, Hartz S. In vitro activity of essential oils extracted from plants used asspices against fluconazole-resistant and fluconazole-susceptible Candida spp. Can JMicrobiol. 2008; 54: 950-956
27. Pozzatti P, Silva E, Guilherme P, Linde M,Morais J, Hartz S. Comparison of the susceptibilities of clinical isolates of Candidaalbicans and Candida dubliniensis to essential oils. Blackwell VerlagGmbh.Mycoses.2008; 53: 12-15.
28. Arshad N, Neubauer C, Hasnain S HM. Peganumharmala can minimize Escherichia coli infection in poultry, but long-term feeding may induce side effects. Poult Sci. 2008; 87:240-9.
29. Nenaah G. Antibacterial and antifungal activities of (beta)-carboline alkaloids of Peganumharmala (L) seeds and their combination effects. Fitoterapia. 2010; 81(7):779-82.
30. Bukhari N, Choi JH, Jeon C, Park MA. K. Phytochemical studies of the alkaloids from Peganumharmala. Appl Chem. 2008; 12:101-4.
31. KartalM, Altun M, Kurucu S. HPLC method for the analysis of harmol, harmalol, harmine and harmaline in the seeds of Peganumharmala L. J Pharmac Biomed Anal, 2003; 31(2):263-9.
32. SarpelehA, Sharifi K, Sonbolkar A. Evidence of antifungal activity of wild rue (Peganumharmala L.) on phytopathogenic fungi. J Plant Dis Protect, 2009; 116(5): 208-215.
33. Newall C. Herbal medicines a guide for health care professionals. The pharmaceutical press.London.1996.
34. Zargari A. Herbal drug. 4th. Tehran university.1989.
35. Shahnaz H, Hifza A, Bushra K, Khan JI. Lipidstudies of *Cuminumcyminum*fixed oil. Pak J Bot 2004; 36(2): 395-401.
36. Sancholy N, GhaffariM, Qaraee A. Comparative study of the antifungal effects of essential oils of Shirazi, Cumin and Indian Cranberry in comparison with formalin on Aspergillus parasiticus aflatoxin producing fungi.Comparative Pathobiology of Iran: Autumn 1394; 12 (3):1691-1698.
37. MinooeianHaghighi M, Khosravi A. The Effects of the Herbal Essences on the Two Important Species of Aspergillus. Horizon Med Sci . 2010; 15 (4) :5-15.
38. Mokhtari A, Khosravi A, SalehiTaghi Z. Antifungal effect and morphological changes of cumin essential oil on isolates of fusarium verticillioids isolated in Iran Comparative Pathobiology - 1391;9(2): 705-714.
39. Shafiee A, Javidnia K. Composition ofessential oil of Zataria multiflora. Planta medica 1997;63:371-2.

40. GandomiH, Misaghi A, Basti AA, et al. Effectof Zataria multiflora Boiss. essential oil on growth and aflatoxin formation by Aspergillusflavus in culture media and cheese. Food ChemToxicol 2009;47:2397-400.
41. DakhiliM., ZahraeiSalehi M.T., TorabiGoudarzi M., Khavari A. Evaluation of Antimicrobial Effects of 4 Medicinal PlantsAgainst Salmonella Typhymurium and Comparison Them With Common Antibioticsin Veterinary Medicine. J Med Plants 2006;5:21-6.
42. FeisstC, Franke L, Appendino G, Werz O. Identification of molecular targets of the oligomeric nonprenylatedacylphlorolucinols from Myrtuscommunis and their implication as anti-inflammatory compounds. J PharmacolExpTher 2005; 315(1): 389-96.
43. Tolouee M, Alinezhad S, Saberi R, Eslamifar A, Zad SJ, Jaimand K, etal. Effect of Matricariachamomilla L. flower essential oil on the growth and ultrastructure of Aspergillus niger van Tieghem. Int J Food Microbiol 2010;139(3):127-33
44. AbabutainIm. Antimicrobial Activity of Ethanolic Extracts From Some Medicinal Plant. Australian Journal of Basic and Applied Sciences 2011;5(11):678-83
45. Agarwal V, Lal P, Pruthi V. Effect of Plant Oils on Candida albicans.JMicrobiolImmunol Infect 2010;43(5):447–451
46. Martinsa N, Ferreirab I, Barrosb L, CarvalhobA,Henriquesa M, Silva S. Plants used in folk medicine: The potential of their hydromethanolic extracts against Candida species . Ind Crops Prod 2015;66 :62–7
47. El-Shouny W, Ismail S, Elzawawy N, Hegazy S. Efficacy of Herbal Control of the Yeasts Isolated from Autistic Children. Glob Chang Biol 2016;5(2):65-73
48. TavakoliporH,SedaniL, Javanmard Interior M. Comparison of Effect of Salvia and Cumin Extracts on Toxinization of Aspergillus Flavus in Pistachio Brain.Innovation in science and technology of food. 2013; 10(2): 37-45.
49.Ataee Z, Ansari M, Ayatollah Mousavi Seyedamin, Mirzaie A. Experimental study of the antifungal effect of Avesenet, Eucalyptus, Onion, Cinnamon, Turmeric, Marigold, Peppermint and Almond Spring on standard strain of Candida albicans compared to Nystatin mouthwash.Journal of Islamic Dental Association of Iran: Summer 2007;19(2): 91-97.

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