Egypt. J. Vet. Sci. **Vol. 53,** No. 1, pp. 1-8 (2022)

Egyptian Journal of Veterinary Sciences
https://ejvs.journals.ekb.eg/

Iranian Native Medicinal Plants Affecting *Staphylococcus aureus* as Septic Pathogens: An updated Review

Masoume Davarpanah[1], Ronak Bakhtiari[1], Mohammad Karimi[2], Seyede Fatemeh Hosseini[3] and Alireza Esmaeili[4,5*]

[1]Department of Pathobiology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.
[2]Department of Infectious Disease, Imam Reza Hospital, Amol, Mazandaran, Iran
[4]Department of Biology, Faculty of Basic Sciences, University of Mazandaran, Babolsar, Iran.
[4]Assistant Professor of Hematology and Oncology, School of Medicine, Ilam University of Medical Sciences, Ilam, Iran
[5]Non-Communicable Diseases Research Center, Ilam University of Medical Sciences, Ilam, Iran.

Staphylococcus aureus is the second leading pathogenic cause of nosocomial infections and plays an important role in the development of food poisoning and purulent, systemic and nosocomial infections. This bacterium is responsible for infections such as abscess, food poisoning, third grade burns, traumatic ulcers, surgical incisions, bed sores or atrophic ulcers. Long-term use of antibiotics has led to the emergence of multi-drug resistant strains in infectious diseases. Due to increased resistance of bacteria to chemical drugs and the few side effects of medicinal plants, medicinal plants have nowadays attracted much more attention of researchers. In this regard, studies have been done on the effectiveness of medicinal plants against infectious agents such as *S. aureus* and methicillin-resistant *S. aureus*. Therefore, in this review study, native Iranian herbs that are effective on *S. aureus* were reported. In this review study, search terms including *Staphylococcus aureus*, herbs, extracts and essential oils were used to retrieve articles indexed in databases such as the *Institute for Scientific Information*, *PubMed*, *Scopus*, *Scientific Information Database*, *Magiran*, and *Google Scholar*. Garlic, pomegranate, *Anethum graveolens*, coriander, eucalyptus, *Lawsonia inermis*, *Descurainia sophia*, Figworts, artemisia, thyme, etc. are some of the most important anti-staphylococcal herbs.

Keywords: Herbal medicine, Infection, Toxic shock syndrome, Toxic sepsis, Antibiotic, Drug resistance.

Introduction

Infectious diseases kill thousands each day around the world [1]. *Staphylococcus aureus* is the second leading pathogenic cause of nosocomial infections [2]. *S. aureus* is a pathogenic bacterium that produces catalase. This bacterium plays an important role in the development of food poisoning and purulent, respiratory, and nosocomial infections [3]. This bacterium is a major contributor to infections such as toxic shock syndrome, toxic sepsis, abscess, food poisoning, third grade burns, traumatic ulceration, surgical incision, bed sores or atrophic ulcers [4, 5]. Reports have indicated that 25-30% of people in different communities are nasal carriers of the bacterium [6]. The increasing incidence of bacterial resistance to antibiotics as well as the side effects of these drugs have been among the factors that have led to the spread of research on medicinal plants in recent years [7]. Long-term use

Corresponding author: Alireza Esmaeili
(*Received* 03/07/2021; *accepted* 22/08/2021)
DOI. 10.21608/ejvs.2021.83742.1246
©2022 National Information and Documentation Centre (NIDOC

of antibiotics has led to the emergence of multidrug resistant strains in infectious diseases [8]. The increasing spread of resistance of *S. aureus* strains to antibiotics is one of the problems that today's medicine faces; and due to the emergence of semi-resistant and resistant strains to common antibiotics and even the last-line drugs such as vancomycin, the future of the treatment of these infectious species has become tentative [9]. Today, *S. aureus* has been identified as the most important cause of nosocomial infection. Currently, over 90% of patients with staphylococcal infections do not respond to penicillin or ampicillin [10,11]. The antibiotic methicillin is the first semi-synthetic penicillin resistant to β-lactamase [12]. Methicillin resistance represents resistance to all penicillinase and cephalosporin-resistant penicillins [13]. Recently, due to the side effects of the used drugs and antibiotics and antibiotic resistance to *S. aureus*, the use of natural antimicrobial compounds and plant compounds has drawn great attention [14]. *S. aureus* is one of the most important infectious agents in humans, and on the other hand, due to the increased resistance of bacteria to chemical drugs and the few side effects of medicinal plants, medicinal plants are nowadays have attracted much more attention of the researchers. In this regard, studies have been done on the effectiveness of medicinal plants against infectious agents such as *S. aureus* and methicillin-resistant *S. aureus*. Therefore, in this review study, native Iranian herbs that were effective on this bacterium were reported.

Methods

To conduct this review, search terms including *Staphylococcus aureus*, herbs, extracts and essential oils were used to retrieve articles indexed in databases such as the *Institute for Scientific Information*, *PubMed*, *Scopus*, *Scientific Information Database*, *Magiran*, and *Google Scholar*.

Results

Garlic, pomegranate, Anethum graveolens, coriander, eucalyptus, Lawsonia inermis, Descurainia sophia, Figworts, artemisia, thyme, etc. are some of the most important anti-staphylococcal herbs. Additional information is shown in Table 1.

TABLE 1. The most important anti-*Staphylococcus aureus* herbs

Scientific Name	Part of plant	Family Name	Type affect	Common name	Origin of plant	Year/ Type of study	Result
Allium Sativum	Bulb	Alliaceae	Aqueous and chloroform extracts	Garlic	Between the Mediterranean and China and common seasoning worldwide	In-vitro 2013	To investigate the effect of extracts, Staphylococcus aureus bacteria cultured in a liquid culture medium were transferred to plates containing Mullerinton agar medium. Then, the disks impregnated with pure dilutions, 12/, containing zinc enzymes, were placed on 12.18, 1/64, 1/32, 16.1, 8.1, and 1/4 Staphylococcus aureus, this test One time for aqueous extract and once for chloroform extract. After incubation, the diameter of the bacterial growth holes was measured. The chloroform extract with a mean diameter of 27±3 without an antimicrobial effect had a stronger antimicrobial effect on Staphylococcus aureus, but the aqueous extract showed a weaker antimicrobial effect with a mean diameter of 17 ° ± 2 ° without dilution and by dilution The extract was reduced, antimicrobial effect decreased, so that at dilution of 32: 1 chloroform extract with mean diameter of the non-growth hole of 1±2 and the aqueous extract with the mean diameter of the no-growth zone was almost zero and in dilutions of 64: 1 and 128 : 1 No bacterial[15].
Punica granatum	Peel	Lythraceae	Peel extract (ethanol)	Pomegranate	It is widly Cultivated throughout the Middle East and Caucasus region ، north Asia and medoterranean.	In vitro 2017	Many previous studies evaluated the antimicrobial potential of P. granatum extracts.in a study the water soluble alkaline fractions contain the highest number of phenolic acids and they were most effective against Gram positive bacteria [16].

Anethum graveolens	Seed	Umbelliferae	An emulsion of water is essential oil	Shevid	_ grown in Eurasia	In vitro 2016	The antimicrobial activity of the essential oil from seeds was evaluated on three pathogenic microorganisms: Staphylococcus aureus (1431 PTCC, Escherichia coli (H7: O157) 35218 ATCC) and Salmonella typhimurium (14028 ATCC), and the lowest inhibitory concentration (MIC) The lowest lethal concentration (MBC) was also determined for this purpose. Six concentrations of each essential oil including 250ppm, 4000.2000,1000,500,125 were selected for this purpose. The seeds of the seed had the lowest inhibitory concentration (MIC) (equivalent to 500 ppm and lowest) The bactericidal concentration (MBC) was 1000 ppm against the bacterium *Staphylococcus*
Coriangrum sativum	Seed	Apiaceae	Coriander oil water emulsion	Geshniz	Native to Southwest Asia and North Africa	Invitro 2016	In this research, the antimicrobial activity of essential oil from coriander seeds on three pathogenic microorganisms: Staphylococcus aureus (1431 PTCC, Escherichia coli (H7: O157) 35218 ATCC) and Salmonella typhimurium (14028 ATCC) were evaluated and the lowest inhibitory concentration MIC and the least lethal concentration (MBC) were determined for this purpose, six levels of concentration of each essential oil including 250 ppm, 4000, 2000, 1000, 500, 125. The essential oil of coriander seeds compared to the essential oil of the seeds was more inhibitory to bacteria Gram negative. The essential oil of coriander seed had MIC and MBC equal to 1000 ppm against the *Staphylococcus aureus* [17].
Eucalyptus	Leaf	Myrtaceae	Vjvshandh aqueous extract of Eucalyptus	Gum trees	Australia And cultivated in Americas, Europe, Africa, the Middle East, China, and the Indian subcontinent.	Invitro 2007	In this study, the antimicrobial activity of Eucalyptus aquatic extract and decoction extract was carried out using agar disc diffusion method. Each test was repeated three times and the mean diameter of the growth hole on the Muller Hinton Agar environment was measured and recorded. Eucalyptus dilutions of 1.2, 1.4, and 1.8 were prepared from aqueous and boiled water extracts. Due to the lack of growth of the bacteria and stomach, Dordish disc diffusion was observed that inhibited the growth of 64% of the bacteria [18].
Lawsonia inermis	Leaf	Lythraceae	Water and ethanol extracts of Henna	Lawsonia Or hina	Native to North Africa, South and West Asia, and Australia	Invitro 2009	A wide range of aqueous and ethanolic extracts of henna were used against *Staphylococcus aureus* So that with a MIC of 50 for this bacterium in aqueous extract is 2.5 mg/ml and ethanol extract is 3 mg / ml. The aqueous extract at a concentration of 7.5 mg/ml could prevent the isolation of 25 isolates of Staphylococcus aureus. Ethanol concentration of 7.5 mg/ml prevents the growth of all isolates of *Staphylococcus aureus* [19].
Descurainia sophia	Seed	Brassicaceae	Ethanolic extract	Hherb-Sophia	The hills in the plains and mountains are in most mountainous regions of the world.	In vitro 2005	In the study of the effect of extracts obtained from husker with distillation in vacuum at a concentration of 5.8, 3.1, 8.8 g / 100 cc distilled water and standard *Staphylococcus aureus*, no inhibition zone was observed around the wells. In fact, the extracts were not able to inhibit the growth or kill of the bacteria and did not have bactericidal or bacteriostatic effects on bacteria [20].

Scrophularia	Aerial part	Scrophulariaceae	Aqueous and Alcoholic Extract	Figworts	A plant that grows in the mountainous areas of Zagros, and its name is local in the province of Ilam, thirsty.	In vitro 2007	The results showed the inhibitory effect of the aqueous and alcoholic extract of the thirsty plant on *Staphylococcus aureus* bacteria. The diameter of the aqueous inhibition of the aqueous extract of this plant on 14 mm *Staphylococcus aureus* bacteria and the ethanolic and methanolic anesthetics of the ethanolic and methanolic extract of the *Staphylococcus aureus* were 10 and 12 mm M. The results of MIC and MBC determination (the lowest inhibitory concentration (MIC) and the lowest effective killer concentration (MBC) for this bacterium were 5 and 10 µg / ml respectively [21].
Artemisia	Aerial part	Asteraceae	Ethanolic extract	Mugwort		Invitro 2006	Antimicrobial effect of *Artemisia* ethanolic extract had an excellent antibacterial effect against *Staphylococcus aureus* resistant and motilcin susceptible strains. The results of F-test showed that value-P value of F-test was in all investigated values of the extract of Artemisia seedlings ($P < 0.05$). MIC results also showed that the ethanolic extract of this plant, even at very low concentrations, inhibited good growth [22].
Thymes	Aerial part	Lamiaceae	Thyme essential oil	Thymus vulgaris	Iran and europe and Romans	Invitro 2012	The results of quantitative testing of MIC from the tested essential oils for antibiotic resistant *Staphylococcus aureus* were as follows. The lowest MIC value for tetracycline-resistant tetanus essential oil was 3.163 µg/ml [23].
Mentha longifolia	Aerial part	Lamiaceae	Ethanolic extract	Wild mint	PALESTINE	In vitro 2006	Antibacterial properties of the ethanolic extract of the plant with a diameter of 14 mm inhibition zone for MRSA has been proved. MIC and MBC were also 3.125 and 12.5 mg/ml respectively [24].
Melissa officinalis	Aerial part	Lamiaceae	Ethanolic extract	Lemon balm	PALESTINE	In vitro 2006	Antibacterial properties of ethanolic extract of the plant with a diameter of 15 mm inhibition zone for MRSA has been proven. MIC and MBC were also 3.125 and 12.5 mg/ml respectively [25].
Rosa damascena	Flower	Rosaceae	Ethanolic extract	Damask rose	PALESTINE	In vitro 2006	Antibacterial properties of ethanolic extract of the plant with a diameter of 34 mm inhibition zone for MRSA have been proven. MIC and MBC were 0.39 and 0.78 mg/ml, respectively [24].
Scutellaria barbata	Leaves	Lamiaceae	Ethereal Extract	Barbed skullcap	Asia	In vitro 2000	The ether extract of this plant with an MIC of 125-250 has antibacterial properties [25].
Camellia sinensis	Leaves	Theaceae	Alcoholic Extract	Tea plan	Chinese	In vitro 2005	Antibacterial effect of ethanolic extract with MIC = 1.8-7.5 mg/ml was proved [26].
Delonix regia	Flowers	Fabaceae	Alcoholic Extract	Flame tree	Madagascar	In vitro 2005	Antibacterial properties of ethanolic extract with MIC = 5-7.5 mg/ml have been proven [27].
Holarrhena antidysenterica	Bark	Apocynaceae	Alcoholic Extract	White angel	Indian	In vitro 2005	Antibacterial effect of ethanolic extract with MIC = 2.8-5.6 mg/ml has been proved [26].
Lawsonia inermis	Leaves	Lythraceae	Alcoholic Extract	Hina	northern Africa, western and southern Asia, and northern Australasia	In vitro 2005	Antibacterial properties of ethanolic extract with MIC = 1.3-7.5 mg/ml have been proven [26].

Punica granatum	Rind	Lythraceae	Alcoholic Extract	Punica granatum	Iran and Mediterraean region and northern India	In vitro 2005	Antibacterial properties of ethanolic extract with MIC = 1.8-5.3 mg/ml have been proven [26].
Terminalia chebula	Fruits	Combretaceae	Alcoholic Extract	Chebulic myrobalan	South East Asia.	In vitro 2005	Antibacterial properties of ethanolic extract with MIC = 1.5-8.2 mg/ml have been proven [26].
Terminalia belerica	Fruits	Combretaceae	Alcoholic Extract	Bastard myrobalan	Southeast Asia	In vitro 2005	Antibacterial properties of ethanolic extract with MIC = 1.8-7.8 mg/ml have been proven [26].
Acorus calamus	Rhizome	Acoraceae	Alcoholic Extract	Sweet flag	South Asia Indian	In vitro 2006	Antibacterial properties of ethanolic extract with MIC = 1.5-3 mg/ml have been proven [27].
Hemidesmus Indicus	Stem	Apocynaceae	Alcoholic Extract	Sarsaparilla	South Asia Indian	In vitro 2006	Antibacterial properties of ethanolic extract with MIC = 1.5-2.8 mg/ml have been proven [27].
Holarrhena Antidysenterica	Bark	Apocynaceae	Alcoholic Extract	White angel	Indian	In vitro 2006	Antibacterial properties of ethanolic extract with MIC = 2.5-3 mg/ml have been proven [28].
Plumbago zeylanica	Root	Plumbaginaceae	Alcoholic Extract	Ceylon leadwort	India	In vitro 2006	Antibacterial properties of ethanolic extract with MIC = 0.75-1.8 mg/ml have been proven [27].
Terminalia avicennioides	Bark	Combretaceae	water and ethanol extracts	-	West Africa.	In vitro 2005	MIC of the extracts was determined by dilution of Terminalia avicennioides Water extract: 20.8 Ethanol extract: 18.2 [28].
Ocimum gratissimum	Leaf	Lamiaceae	water and ethanol extracts	Clove basil	Africa, Madagascar, southern Asia	In vitro 2005	MIC of the extracts was determined by dilution of *Ocimum gratissimum - Water extract: 25.0 and Ethanol extract :22.3* [28].
Acalypha wilkesiana	Leaf	Euphorbiaceae	water and ethanol extracts	-	In South Florida and tropical America.	In vitro 2005	MIC of the extracts was determined by dilution of Acalypha wilkesiana *Water extract:* 24.5 *Ethanol extract* : 24.0 [28].
Melaleuca alternifolia	leaves	Myrtaceae	oil	Tea tree	Endemic To Australia	In Vitro 1997	The MIC was defined as the lowest concentration of each oil that inhibited visible growth after overnight incubation in air at 37°C. MIC : 0.25 mg/ml [28].
R. repens	leaves		oil	-	Iran	In-vitro 2020	MIC: 50 µl [47].
P. harmala fruit	Leaves, fruit		oil	-	Iran	In-vitro 2020	MIC: 50 µl [47].
J. conglomeratus	Fruit		oil		Iran	In-vitro 2020	MIC: 50 µl [47].
Eremurus persicus			Ethanol Extract			In-vitro 2020	MIC: 2.55 ppm [48].

Discussion

The effect of medicinal plants on infectious and bacterial agents has been investigated in different studies. Native herbs of Iran and their effects on infectious agents such as *S. aureus* have been addressed in this review. Many of the herbs also have anti-inflammatory and antimicrobial effects due to the above-mentioned active ingredients and possibly inflammatory and microbial processes. The effects of medicinal plants on infectious diseases are undeniable, and it is a common practice to use them either traditionally, or to prepare processed, nature-based products used to control and treat infections and microbial diseases. According to several studies on numerous plants, their effects have been scientifically proven. This information can be used to produce effective pharmaceutical products. In herbs, there are drug combinations and antioxidants that are responsible for the therapeutic effects45-47]]. The active ingredients of these plants, which include anthocyanins, phenolic compounds, flavonoids and flavones, tannins and other bioactive substances, can be used to produce antibacterial products.

Funding statements

This review was funded by the Isfahan University of Medical Sciences, Isfahan, Iran.

Conflict of Interest

This is a review article, no conflict of interest.

References

1. Beg, A.Z. and Ahmad, I. Effect of Plumbago zeylanica extract and certain curing agents on multidrug resistant bacteria of clinical origin. *World J. Microbiol. Biotechnol.,* **16** (8-9), 841-4(2000).

2. Bacteriology at UW Madison Bacteriology 330 Home page. Staphylococcus. 2002 Kenneth epidermis. Pathogenic *Staphylococcus epidermis*. Available at: http://www.bact.wisc.edu/bact330/lecturestaph, (2009).

3. Kloos, W.E. Staphylococcus. In: Topley & Wilson's Microbiology & Microbial infections. Collier L., Balows A., Sussman M., 9th ed.; Vol. 2. Arnold Co; USA. 577- 617 (1998).

4. Nwanze, P.I., Nwaru, L.M., Oranusi, S., Dimkpa, U., Okwu, M.U. and Babatunde, B.B. Urinary tract infection in Okada village: Prevalence and antimicrobial susceptibility pattern. *Sci. Res. Essays.*, **2** (4), 112-116 (2007).

5. Shopsin, B. and Kreiswirth, B. Molecular epidemiology of methicillin resistant *Staphylococcus aureus*. *Emerg. Infect. Dis.,* **7** (2), 323-326 (2001).

6. Kluytmans, J., van Belkum, A. and Verbrugh, H. Nasal carriage of Staphylococcus aureus: epidemiology, underlying mechanisms, and associated risks. *Clin. Microbial. Rev.,* **10** (3), 505-520 (1997).

7. Fani, M. and Kohanteb, J. Inhibitory activity of Aloe vera gel on some clinically isolated cariogenic and periodontopathic bacteria. *Journal Oral Sci.,* **54**(1), 15-21 (2012).

8. Singh, G., Kapoor, I.P. and Pandey S.K. Studies on essential oils: part 10; antibacterial activity of volatile oils of some spices. *Phytother. Res.,* **16**(7), 680-682 (2002).

9. Tiemersma, E.W., Bronzwaer, S.L., Lyytikainen, O., Degener, J.E., Schrijnemakers, P. and Bruinsma, N. European Antimicrobial Resistance Surveillance System Participants Methicillinresistant *Staphylococcus aureus* in Europe, 1999- 2002. *Emerg. Infect. Dis.,* **10**, 1627 – 1634 (2004).

10. Harbarth, S., Fankhauser, C., Schrenzel, J., Christenson, J., Gervaz, P. and Bandiera-Clerc, C. Universal screening for methicillinresistant *Staphylococcus aureus* at hospital admission and nosocomial infection in surgical patients. *J. American Med. Association,* **299**(10), 1149-1157 (2008).

11. Otter, J.A. and French, G.L. Survival of nosocomial bacteria and spores on surfaces and inactivation by hydrogen peroxide vapor. *Journal of Clinical Microbiology*, **47**(1), 205-207 (2009).

12. Parsonnet, J. and Deresiewicz, R.L. Staphylococcal infections. In: Baunwald E, Fausi AS, editors. Harrison's Principles of internal medicine. 15 th ed. New york: McGrawHill, 889901 (2001).

13. Franklin, D. and Lowy, M.D. Staphylococcus aureus infection. *N. Engl. J. Med.,* **339**(8), 520-532 (1998).

14. Tiemersma, E.W., Bronzwaer, S., Lyytikainen, O., Degener, J.E., Schrijnemakers, P. and Bruinsma, N. European antimicrobial resistance surveillance system participants (methicillin-resistant *Staphylococcus aureus* in Europe,1992-2002). *Emerging Infectious Dis. J.,* **10**(9), 27- 34 (2004).

15. Moradkhani, S., and Molaabaszadeh, H. Antimicrobial effect of the Allium Sativum aqueous and chloroform extracts on Staphylococcus aureus. *Iran. J. Infectious Dis.,* **20** (68), 67-73 (2015).

16. Khan, I., Rahman, H., Nasser, M., El-Salam, A., Tawab, A., Hussain, A., Ali Khan, T., Ali Khan, U., Qasim, M., Adnan, M., Azizullah, A., Murad, W., Jalal, A., Muhammad, N. and Ullah, R. Punica granatum peel extracts: HPLC fractionation and LC MS analysis to quest compounds having activity against multidrug resistant bacteria. *BMC Complementary and Alternative Med.,* **17**, 247, pp. 1-6(2017). doi: 10.1186/s12906-017-1766-4

17. Broomand, A., Hamedi, M., Emamjomeh, Z., Razavi, S.H. and Gholmakani, M.T. Investigation on the antimicrobial effects of essential oils from dill and coriander seeds on Staphylococcus aureus, Escherichia coli O157:H7 and Salmonella typhimuruim. *Iranian J. Food Sci. Technol.,* **7**(1)1-10 (2017).

18. Dadgar ,T., Ghaemi, E., Asmar, E., Mazandarani, M. and Bazueri, M. Antibacterial activities of six medicinal plants against methicillin-resistant and sensitive *Staphylococcus aureus*. *Iranian J. Med. Arom. Plants,* **23**(1), 73-85 (2007).

19. Behdani, M., Ghazvini, K., Mohammadzadeh A.R., and Sadeghian A. Antibacterial activity of Henna extracts against *Staphylococcus aureus* and *Pseudomonas aeroginosa*. Ofogh-e-Danesh. *GMUHS J.*, **15**(3), 46-52 (2009).

20. Torabian, P., Ghandehari, F. and Fatemi, M. Effect of Husker Extract on the Prevention of the Growth of Strains of *Escherichia coli* and *Staphylococcus aureus*. *Babol. Uni. Med. Sci.,* **8**(5), 26-30 (2006).

21. Zamanian-Azodi, M. The effect of water and alcohol extract of *Scrophularia striata* Boiss. on *Staphylococcus aureus* and *Pseudomonas aeruginosa* bacteria in laboratory environment. *Quarterly Recognition and Application of Medicinal Plants J.*, **1**(3), 33-40 (2008).

22. Dadgar, T., Ghaemi, E., Bazueri, M., Asmar, M., Mazandarani, M., Saifi, A. and Bayat, H. Antibacterial effect of 20 species of medicinal plants against *Staphylococcus aureus* resistant and sensitive to methicillin. *Gorgan Uni. Med. Sci. J.,* **9**(1), 21, 55-62 (2007).

23. Vaziri, S. , Hamzeh pourb , S. and Dalvand, M. Evaluation of Antimicrobial Effects of Shirazi Thyme Essential Oil on Staphylococcus aureus resistant to antibiotics isolated from food. *Kurdistan Uni. Med. Sci. J.,* **18**(2), 21-29 (2012).

24. Abu-Shanab, B., Adwan, GH., Jarrar, N., Abu-Hijleh, A. and Adwan, K. Antibacterial Activity of Four Plant Extracts Used in Palestine in Folkloric Medicine against Methicillin-Resistant Staphylococcus aureus. Turk. J. Biol., 195-198 (2006).

25. Sato, Y., Suzaki, Sh., Nishikawa, T., Kihara, M., Shibata, H. and Higuti, T. Phytochemical flavones isolated from Scutellaria barbata and antibacterial activity against methicillin-resistant Staphylococcus aureus. J. Ethnopharmacol., 72, 483–488 (2000).

26. Farrukh Aqil, M. Sajjad A. Khan, Mohd Owais1 and Iqbal Ahmad. Effect of certain bioactive plant extracts on clinical isolates of β-lactamase producing methicillin resistant Staphylococcus aureus. J. Basic Microbiol., 45(2) 106–114 (2005).

27. Aqil, F., Ahmad, I. and Owais, M. Evaluation of anti-methicillin-resistant Staphylococcus aureus (MRSA) activity and synergy of some bioactive plant extracts. *Biotechnol. J.* **1**, 1093–1102 (2006).

28. Kabir, O., Oladapo, O., Okwara, C.H., Ibe, C.C. and Fasure, K. Screening of crude extracts of six medicinal plants used in South-West Nigerian unorthodox medicine for anti methicillin resistant Staphylococcus aureus activity. *BMC Complementary and Alternative Medicine.* **5**, 6, pages 1-7(2005). DOI: 10.1186/1472-6882-5-6

29. Nelson, R.R.S. In-vitro activities of five plant essential oils against methicillin-resistant Staphylococcus aureus and vancomycin-resistant Enterococcus faecium. *J. Antimicrob. Chemother.,* **40**, 305–306 (1997).

30. Shojaei Moghadam, M., Maleki, S., Darabpour, S., Motamedi, H. and Seyyed Nejad, S.M. Antibacterial activity of eight Iranian plant extracts against methicillin and cefixime restistant Staphylococcous aureus strains. *Asian Pacific J. Tropical Med.,* volume….262-265(2010).

31. Ghasemi Pirbalouti, A., Malekpoor, F., Momtaz, H. and Hamedi, B. . Antibacterial Activity of Some Folklore Medicinal Plants Used by Bakhtiari Tribal in Southwest Iran. *International J. Biol.,* **2** (2), 55-63 (2010).

32. Abolhassani, M. Antibacterial Effect of Borage (Echium amoenum) on Staphylococcus aureus. *The Brazilian J. Infec. Dis.,* **8**(5), 382-385 (2004).

33. Abbasvali, M., Esmaeili Koutamehr, M., Moshtaghi, H. and Hadi Eskandari, M. Effect of leaf extract of olive (Olea europaea) cultivars on Staphylococcus aureus. Online *J. Vet. Res.,* **19**(8), 519-529 (2015).

34. Irani, M., Sarmadi, M., Bernard, F., Ebrahimi pour G.H.H. and Shaker Bazarnov, H. Leaves Antimicrobial Activity of Glycyrrhiza glabra L. *Iranian J. Pharmaceutical Res.,* **9** (4), 425-428(2010).

35. Razavi, S.M, Zarrini, GHR., Molavi, G.H. and Ghasemi, G.H. Bioactivity of Malva Sylvestris L., a Medicinal Plant from Iran. Iranian J. Basic Med. Sci., **14**(6), 574-579 (2011).

36. Mansouri, S.H. Inhibition of staphylococcus aureus mediated by extracts of iranian plants. *Pharmaceutical Biol.,* **37**(5), 375–377 (1999).

37. Abdollahzadeh, R.Y., Mashouf, H., Mortazavi, M., Moghaddam, H., Roozbahani, N. and Vahedi, M. Antibacterial and Antifungal Activities of Punica Granatum Peel Extracts Against Oral Pathogens. *J. Dentistry, Tehran Uni. Med. Sci., Tehran, Iran.* **8** (1), 1-6 (2011).

38. Schulz, V., Hansel, R. and Tyler, V.E. Rational Phytotherapy: A Physicians' Guide to Herbal Medicine. 3rd ed. Berlin. Germay. Springer-Verlag: 112 (1998).

39. Sadrnia, M. and Arjomandzadegan, M. Comparative study on the effects of Aloe vera extract in clinical strains of Staphylococcus aureus, Klebsiella, Staphylococcus epidermidis and Escherichia coli compared to antibiotics of choice. *Arak. Medical University J.,* **17**(87), 39-46 (2014).

40. POURJABALI, Masoumeh, et al. Medicinal plants used for hypertension. *J. Pharmaceutical Sci. Res.,* **9**(5), 537-541 (2017).

41. 0Ghamari, S. Identifying medicinal plants affecting the teeth from the Southern district of Ilam province, Iran. *J. Pharmaceutical Sci. Res.,* **9**(6), 800 (2017).

42. Naserifar, R. A review of the most important native medicinal plants of Iran effective on leishmaniasis according to Iranian ethnobotanical references. *Int. J. Adv. Biotechnol. Res.,* **8**, 1330-1336 (2017).

43. Munzuroğlu, O., Karataş, F. and Gür, N. A Study of the Levels of Vitamins A, E and C and Selenium in Rhubarb (Rheum ribes L.) *Turk. J. Biol.,* **24**, 397 – 404 (2000).

44. Ayoubi, B., Darvishi, S. and Mirahmadi, F. Antibacterial properties of Kurdistan Gundelia tournefortii ethanolic extract against Staphylococcus aureus and Escherichia coli. *J. Food Hygiene,* **6** (2), 73-91 (2016).

45. Tajallaie-Asl, F., Mardani, M., Shahsavari, S. and Abbaszadeh, S. Menstruation phytotherapy according to iran ethnobotanical sources. *J. Pharm. Sci. Res.,* **9**(6), 986-990 (2017).

46. Abbaszadeh, S., Nosrati Andevari, A., Koohpayeh, A., Naghdi, N., Alizadeh, M., Beyranvand, F. and Harsej, Z. Folklore medicinal plants used in liver disease: A review. *Int. J. Green Pharma,* **12**, 03. (2010),

47. Moradi, B., Abbaszadeh, S., Shahsavari, S., Alizadeh, M. and Beyranvand, F. The most useful medicinal herbs to treat diabetes. *Biomed. Res. Therapy.*, **5**(8), 2538-2551 (2018).

48. Hadadi, Z., Nematzadeh, G.A. and Ghahari, S. A study on the antioxidant and antimicrobial activities in the chloroformic and methanolic extracts of 6 important medicinal plants collected from North of Iran. *BMC Chem.,* **14**, 33 (2020).

49. Farid Rahmani, A., Ghanavati-Behbahan, F. and Moradi, Y. Antimicrobial Effects of Ethanol Extract of Eremurus persicus Leaves on Staphylococcus Aureus under Laboratory Conditions. *Int. J. Adv. Biolog. Biomed. Res.,* **9**(1), 58-63 (2012).