



## ORIGINAL ARTICLE

# Antibacterial Activity of the Extract of Oak (*Quercus persica*) Fruits

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### ABSTRACT

This study was performed to assess the antibacterial effects of the extracts of oak fruits, collected in different areas of the Zagros mountains, western Iran, against two positive (*Staphylococcus aureus* and *Bacillus subtilis*), and two negative bacteria (*Klebsiella pneumonia* and *Escherichia coli*) with disc diffusion method. According to the results of this study, the effect of solphamecine (positive control) was more than plant extracts effects. Although the effects of oxytetracycline against *S. aureus* and *B. subtilis* were in lowest level, its effect was more than plant extracts against *K. pneumonia* and *E. coli*, and, negative control was at its lowest amount in all treatments. The effect of Ghelane Gharb extract, furthermore, was more than the other plant extracts.

**Keywords:** Extract, Oak, Different regions, Antibacterial Activity.

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### INTRODUCTION

Herbs and spices products have a wide range of applications in folk medicine, food flavoring, and preservation as well as in food industries [4]. In recent years there has been an increasing interest in the use of natural substances due to concern about some the safety of synthetic compounds, which have encouraged more detailed studies on originated substances [3]. Medicinal plants contain plant materials such as leaf, root, flower and seed using in the form of their extracts and chemical compounds to produce human drugs or veterinary medicine [13]. Properties of medicinal plants are due to the presence of various complex chemical substances from different composition which named secondary metabolites. Medicinal and aromatic plants form a large group of economically important plants that provide the basic raw materials for indigenous pharmaceuticals, perfumery, flavor and cosmetic industries [10].

The extracts and essential oils of many plants have been shown to exert biological activity, which justified research on traditional medicine focused on the characterization of antimicrobial activity of these plants. Iran, India, Pakistan, Turkey, Jordan, Brazil and Mexico are examples of countries that have a diverse flora and a rich tradition in the use of medicinal plants for antibacterial applications [5, 8, 11]. In the several researchers the antibacterial activities of different parts of oak have been studied [1, 2, 7].

Zagros broadleaf deciduous forest, consisting mainly of oak forest, covers 5.5 million ha in Western Iran [16]. According to this fact, the present study aimed to screen antibacterial properties of the extracts of oak fruits against two positive and two negative bacteria.

### MATERIALS AND METHODS

Collecting the fruits was done in six distances from the Zagros regions, Western Iran. The distances were Hamzeh (Latitude 3716805, Longitude 248636 and Altitude 1276), Dinarvand (Latitude 3696161, Longitude 252646 and Altitude 1452), Mareh khell (Latitude 3875612, Longitude 601667 and Altitude 1231), Ghelane Gharb (Latitude 3775826, Longitude 587025 and Altitude 969), Chavar (Latitude 3723952, Longitude 621845 and Altitude 1201) and Maymeh (Latitude 3680125, Longitude 677706 and Altitude 1292).

After sampling, samples dried in shadow for 20 days. In order to extract, first the samples were crushed hefty to decrease the volume rather than the level. Then 10 gr of each fruit sample was put in a 1-litre jar and about 100 ml 96% alcohol was added to it. Afterward, the samples were in the room temperature and away from sunlight, for 72 hours. During the time, samples were shaking and mixing for several times. Then in order to thicken the extract, Rotary set was used, and this action (thickening) was done in half an hour. Finally the mere extract was poured in Petri dish, and was tightly covered by its leaves, then in 0-4 °C till the time of antimicrobial activity determinate [14].

The antibacterial activities of extracts were determined with the disc diffusion method [12] against *Staphylococcus aureus* (PTCC 1112), *Bacillus subtilis* (PTCC 1254), *Klebsiella pneumonia* (PTCC 1053) and *Escherichia coli* (PTCC 1270) bacteria. Briefly, bacterial suspensions were adjusted to  $1 \times 10^7$  CFU mL<sup>-1</sup> and spread in TSA or PCA using sterile cotton swabs. Subsequently, filter paper discs (6 mm Ø; Whatman #1) were placed on the surface of Petri dishes and impregnated with 20 µL of extract at different concentrations (diluted in DMSO). Positive controls were prepared with oxytetracycline and solphamecine, but negative controls were prepared only with DMSO. After staying at 4 °C (2 h), all Petri dishes were incubated at 30 °C (24 h). All determinations were performed in triplicate. Antibacterial activity was evaluated by measuring the radius of the inhibition zones to the nearest millimeter [17]. Finally for doing statistical analysis and for drawing the diagrams, the software SAS and EXCEL 2007 were used subsequently and comparing the average of data was done by Duncan's multiple range test.

## RESULTS AND DISCUSSION

The results of comparing the average of inhibition zones against *S. aureus* showed that the most inhibition zone among plant extracts was in Ghelane Gharb extract, however, effects of positive controls were more than plant extracts, the least amount of inhibition zone was in negative control (DMSO) (Fig. 1). Inhibition zones of Hamzeh, Dinarvand, Mareh Khell, Chavar and Maymeh extracts against *B. subtilis* didn't have any significant different, moreover, the inhibition zone of Ghelane Gharb extract was in a different statistical group. According to Fig 2, the lowest amount of inhibition zone was in DMSO and the highest amount of it was in oxytetracycline and solphamecine (Fig. 2).

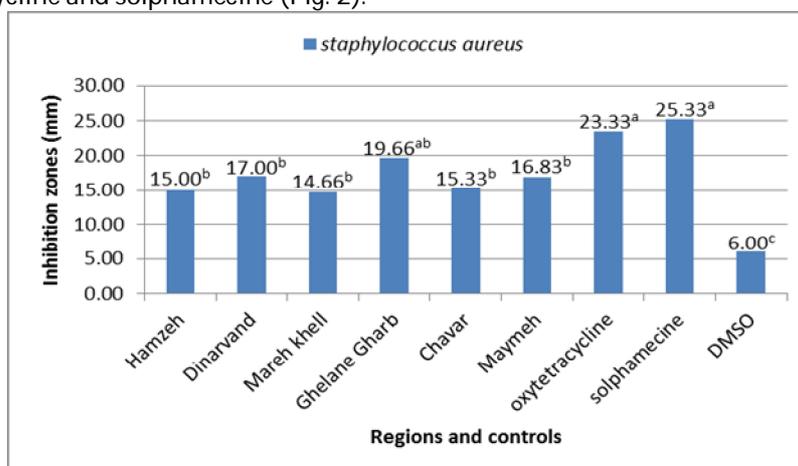


Fig. 1. The inhibition zones of *Staphylococcus aureus* in the presence of extracts and controls.

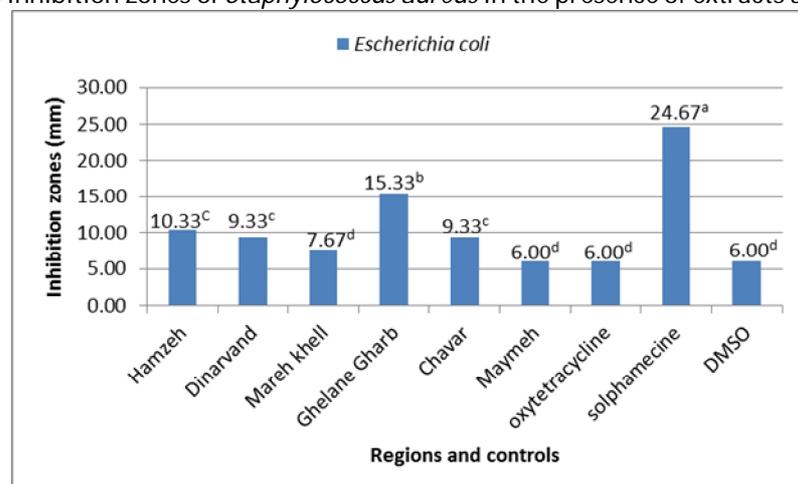


Fig. 2. The inhibition zones of *Bacillus subtilis* in the presence of extracts and controls.

The inhibition zones of Ghelane Gharb extract against *E. coli* had a significant different with other plant extracts, nevertheless, the highest amount of inhibition zone was in solphamecine and was at its lowest level in Maymeh (Fig. 3). Also, the results of comparing the average of inhibition zones against *K. pneumoniae* showed that the most inhibition zone among treatments was in solphamecine and Maymeh extract was at its lowest level among plant extracts (Fig. 4).

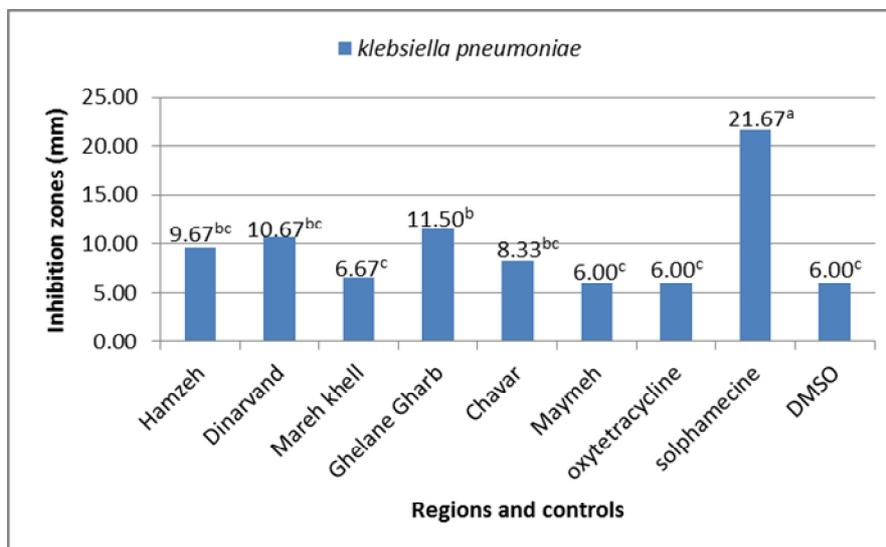


Fig. 3. The inhibition zones of *Escherichia coli* in the presence of extracts and controls.

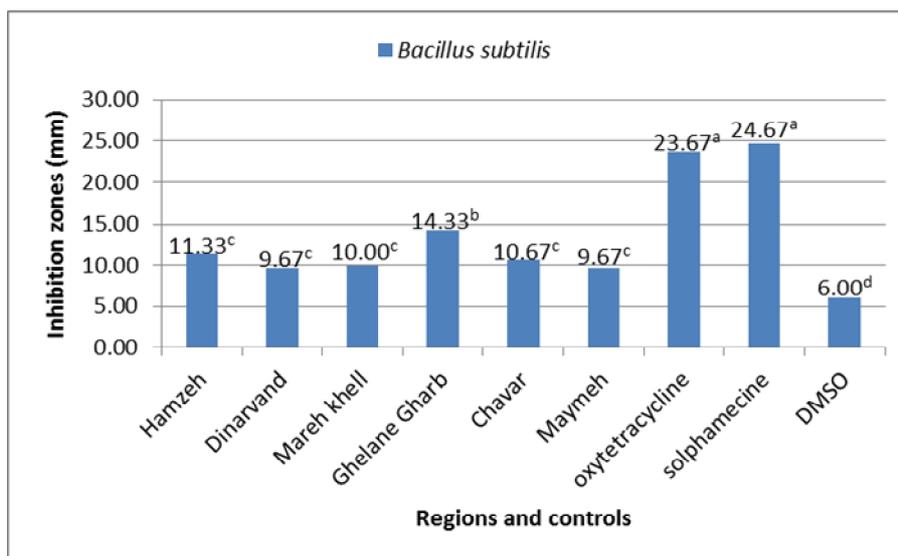


Fig. 4. The inhibition zones of *Klebsiella pneumoniae* in the presence of extracts and controls.

In this study, the antibacterial results showed variation between different extracts. This difference is probably due to the chemical composition of the extracts. Tannin and Gallic acid are the main components of oak tree [9]. Tannins are rather unstable compounds which undergo various types of reactions, leading to further complexity of composition [6]. Gallic acid seems to have antifungal and antiviral properties. It acts as an antioxidant and helps to protect human cells against oxidative damage. Gallic acid is found in other species like the North American white oak and European red oak [15].

## CONCLUSION

It is becoming increasingly difficult to ignore the role of plants extracts in antibacterial activities. The results of current study provide antibacterial activity of the extracts of oak collected from different natural habitats in the Zagros regions, western Iran. Oak has been used as a food flavoring and preservative agents in foods in Iran. The extract of oak is effective for control of bacteria strains, especially *S. aureus* and so could be used as a natural antimicrobial agent. To sum up, according to the results of this study, there was a different inhibition zone among the populations.

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