Journal of Biotechnology Research
ISSN(e): 2413-3256, ISSN(p): 2413-8878
Vol. 2, No. 5, pp: 31-35, 2016
URL: http://arpgweb.com/?ic=journal&journal=16&info=aims

Antimicrobial Activity of Extracts from Salvia officinalis L on some Bacteria and Yeast

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Abstract: The present study was conducted to evaluate the in vitro antimicrobial activity of commercial extracts of *Salvia officinalis* L. against *Coliformes spp., Pseudomonas spp., Saccharomyces cerevisiae, Zygosaccharomyces bailii* and *Lactobacillus plantarum*. Antimicrobial activity of extracts was investigated on the basis of Inhibition zones (IZ) measurement by Agar well diffusion method at concentrations of 10, 50 and 100 ppm. Extracts exhibited IZ between 0 and 4.3 mm against the five tested microorganisms. Maximum inhibition (4.3 mm) was shown by 10 ppm of this oil against *Z. baillii*, while 100 ppm was inactive against *Coliforms spp.* and *Z. baillii*. *Coli forms spp, Z. baillii* and *Pseudomonas spp.* were more sensitive to the oil than *S. cereviceae*and *L. plantarum.*

Keywords: *Salvia officinalis*; Extract; Antimicrobial; Microorganisms.

1. Introduction

The genus *Salvia*, commonly called sage, is the largest member of *Lamiaceae* or mint family containing over 900 species throughout the world [1]. *Salvia officinalis* L., probably the most known species of the *Salvia* genus [2] and commonly known as garden or red sage, is a perennial hardy sub-shrub native to Mediterranean regions and is one of the most popular medicinal and culinary herbs used in the Arab world [3]. Sage tea has been traditionally used for the treatment of digestive and circulation disturbances, bronchitis, cough, asthma, angina, mouth and throat inflammations, depression, excessive sweating, skin diseases, and many other diseases. *Salvia* essential oils have been used in the treatment of a wide range of diseases like those of the nervous system, heart and blood circulation, respiratory system, digestive system, and metabolic and endocrine diseases [4]. In addition, They possess a number of biological activities including antiseptic, antibacterial [5, 6] antioxidant [7] astringent, anti-inflammatory [8, 9], [8-10], antiviral [11, 12], antitumoral [13] cytotoxic [6, 14, 15], spasmolitic, anticonvulsant [16] antimycobacterial [17], and carminative activities [18].

Essential oil of sage contains cineole, borneol, and thujone. Sage leaf contains tannic acid, oleic acid, ursonic acid, ursolic acid, niacin, nicotinamide, flavones, flavonoid glycosides, cornsole, cornsolic acid, fumaric acid, chlorogenic acid, caffeic acid, and estrogenic substances [19].

This study reports the antimicrobial activity of the extract of *S. officinalis* against *Coliform spp., Pseudomonas spp., Saccharomyces cerevisiae, Zygosaccharomyces bailii* and *Lactobacillus plantarum*.

2. Materials and Methods

2.1. Extracts

Salvia officinalis extract was commercially purchased fromFarmalabor (Canosa di Puglia, Italy).

2.2. Tested Microorganisms and Cultures Preparation

Bioassays of the antimicrobial activity of *Salvia officinalis* extract were performed using three strains of bacteria and two yeasts. *Coliform* spp and *Pseudomonas* spp isolated by the Laboratory of Applied Microbiology (University

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of Foggia, Italy), while *Saccharomyces cerevisiae* EC1118 (Lallemand Inc.), *Zygosaccharomyces bailii* DSMZ 70492 and *Lactobacillus plantarum* DSMZ2601 were obtained from the German Collection of Microorganisms and Cell Cultures (Deutsche SammLung von Mikroorganismen und Zellkulturen GmbH, DSMZ, Germany).Microbiological media were purchased from Oxoid Ltd (Basingstoke, UK) and Biolife (Milan, Italy).Cultures for antimicrobial activity tests were prepared by transferring a loop of cells from the agar slant to a test tube containing 10 ml of Nutrient agar for bacteria and yeast or MRS for*L. plantarumin*. They were then incubated overnight (16 h) at 37°C for bacteria and 25°C for the yeast.

2.3. Antimicrobial Activity Assay

The agar well diffusion method was used to determine the antimicrobial activities of *Salvia officinalis* extract (modified Kirby-Bauer method). Briefly, culture medium was inoculated with the overnight culture of the microorganisms bystreaking using sterilized cotton swabs the microbial suspension in the media, MRS for *L. plantarumin* and the solidified Nutrient agar for Coliform spp, *Pseudomonas* spp, *S. cerevisiae* and *Z.bailii*.

Three wells were punched in the agar using a sterile borer and the extract (10, 50 or 100 ppm) was placed into them.The control was set in parallel without extract. The zones of growth inhibition around the wells were measured inmillimeters after 24 h of incubation at 37°Cfor the bacteria and 25°C for the yeast.

3. Results and Discussion

The extracts of *S.officinalis* were screened against three bacteria strains (Coliform spp, *Pseudomonas* spp and *L. plantarumin*) and two yeast (*S. cerevisia* and *Z.bailii*) strains. The results of the effect of the extracts from *S.officinalis* on tested microbial strains are shown in Table below.

The extractinhibited the growth of both bacteria and yeast at diameter zone of inhibition ranging between no inhibition to and 4.3mm.The result showed that the yeast of *Z. baillii* was the best-inhibited microorganism with a mean inhibition zone of 3 to 4.3 mm by *S. officinalis* extract. No inhibition was shown by Coliform spp and *Z. baillii* at a concentration of 100 ppm. While *S. cereviceae* was the least inhibited with a zone of 1 to 2 mm by this extract.

Table. Results of agar-well diffusion test of various concentration of *S. officinalis* extract against bacteria and yeasts.

		Microorganisms				
		Coliform spp	*Pseudomonas* spp	*S. cereviceae*	*Z. baillii*	*L. plantarum*
O.C	10 ppm	2.5	3	1	4.3	2.5
	50 ppm	3.5	2.5	2	3	2
	100 ppm	NI	1	1	NI	2

NI: no inhibition,O.C : Oil concentration

These findings are in accordance with the results recorded in the investigation of Yousefzadi, *et al.* [20] where *Salvia multicaulis* essential oils exhibited a weak activity against *S. cerevisiae*.

Many publications have documented the antimicrobial activity of *S.officinalis* oils against different microbial species [6, 21-28].

Stanjević, *et al.* [29] were tested the antimicrobial activity of the aqueous extract of *S. officinalis* L. against *Bacillus mycoides, B. Subtilis, S.aureus, Agrobacterium radiobacter var. tumefaciens, Enterobacter cloacae, Erwinia carotovora, E. coli, Pseudomonas fluorescens* and *Proteus sp.* and found that *B. mycoides, B. subtilis, E. cloaceae* and *Proteus* sp. (MIC was 10mg/ml) were the most sensitive bacterial strain, While *E. coli* (40 mg/ml) was the most resistant. Similarly, Khalil and Li [30] during their study on the essential oil of *Salvia officinalis* against *E. coli, P.aeruoginosa, S.typhi, S. aureus, Streptococcus group D* and *C.albicans*, showed that *S. aureus, Streptococcus* and *C. albicans* were most susceptible than *E. coli,S. typhi* and *P.aeruoginosa*.

Abu-Darwish, *et al.* [31] had screened *S. officinalis* essential oil for their antimicrobial activity against five yeast (*Candida albicans, C. parapsilosis, C. tropicalis, C.guilliermondii* and *Cryptococcus Neoformans*), seven dermatophytes (*Epidermophytonfloccosum, Trichophyton mentagrophytes, T.rubrum, T. mentagrophytes* var. *interdigital, T. verrucosum, Microsporum canis* and *M. gypseum*) and three *Aspergillus* strains (*Aspergillus Niger, A. fumigatus* and *A. flavus*). They observed that *S. officinalis* extracts exhibit strong growth inhibition against dermatophytes in comparison with yeast and *Aspergillus* sp, especially *T. rubrum* and *E.floccosum*(MIC, 0.64 µL/mL).The antimicrobial activity of essential oils depends on their chemical composition [32]. Their biological activities can be explained by the presence of major components. But, it can also be due to the presence of interaction between different volatile constituents [33]. The chemical composition of the essential oil of sage of different regions in the Mediterranean basin such as the former Yugoslavia [34, 35], Italy [36, 37], Egypt [38], Morocco [39], Algeria [28] and Tunisia [40] etc. has been the subject of several studies and they were almost unanimous that the major components of the essential oils of this plant are the α-thujone, 1,8- cineole and camphor are well known for their antimicrobial activity [41-44]. However, the role of other minor compounds should not be neglected. Some studies have concluded that whole essential oils have agreater antibacterial activity than the major componentsmixed [45, 46] which suggests that the minor components are critical to the activity and may have a synergistic effect or potentiating influence. According to the literature data, the lesser inhibitory activity exhibited by

S. officinalis extract could be explained by the absence of the active compoundsor they are presented in low concentration.

Manou, *et al.* [47] and Bagamboula, *et al.* [48], see that there is no relationship between the concentration of essential oil or active compound and the zone of inhibition, but its activity seems to depend on the capacity of the essential oils to disseminate uniformly in agar.

4. Conclusion

The results obtained confirmed that the extract of *Salvia officinalis* L. possesses an antimicrobial activity against all tested organisms. Therefore, it is beneficial to human health. It has the potential to be used for medical purposes and to be utilized as a natural preservative ingredient in food and cosmetic industries.

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