

Antifungal effects of the extracts of the shallots and artichokes on *Candida albicans*

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Received: 6/Jan/2016 Accepted: 24/Apr/2016

ABSTRACT

Background and aims: Over the recent decades, the infections caused by the opportunistic fungus including the *Candida albicans* (*C. albicans*) have increased, thereby causing the high rate of diseases. With respect to the limitations of the treatment of the fungal infections and expensive antifungal drugs, researchers have been increasingly interested in finding anti-fungal drugs. This study aims to investigate the antifungal effects of the extracts of the shallots and artichokes on *C. albicans*.

Methods: In this experimental research, the extracts of the shallot and artichoke were prepared using a rotary device. The inhibitory concentration against *C. albicans* was determined using incubation in media.

Results: The results of the study showed that increased concentration of the extract increased the antifungal effects. The extract of the artichoke had higher inhibitory effect compared to the extract of the shallot. Moreover, as the extract was decreased the size of the fungi colony was increased.

Conclusion: The results of the study showed that extracts of the shallots and artichoke were proper inhibitors for the *C. albicans* and it is hoped that herbal medicines and possibly new compounds for treatment of the fungal infections be discovered in future.

Keywords: Antifungal Activity, Shallot, Artichoke, *Candida albicans*.

Original article

INTRODUCTION

A variety of factors such as viral, bacterial, parasitic and fungal factors cause the human genitourinary tract diseases. *Candida* is the second common vaginal infection after the non-specific vaginitis, but it is not classified as a sexually transmitted infection. In the recent years, its prevalence in developing countries has been increasing.¹

C. albicans is a natural fungus in warm-blooded animals and human beings.² It

causes two kinds of infection depending on the host: superficial infections in healthy people and deep infections in people with severe immune disorder.³

C. albicans is responsible for 85 to 90% of the vaginal fungi infections, because it tends to bind the vaginal mucosa compared to the others.⁴⁻⁶ Increased resistance of this drug and increased dose of the common drugs, followed by the increased side effects of

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drugs, have caused the natural medicinal plants with mild side effects to be taken into consideration.

Due to the increasing prevalence rate of the fungal diseases in patients such as HIV/AIDS patients, diabetic individuals, a great number of antibiotics consumers, and those who undergo the chemotherapy, and due to the drug resistance, including the inherent or acquired resistance; plant drugs have been increasingly considered because of their high efficiency and low rate of side effects. Since a long time ago, plant drugs have been one of the most important drugs in the world and nowadays, they are of great importance too. Notably during the past decades, the application of these plants in traditional and modern medicine has been rising.⁷ Shallots with the scientific name of *Allium ascalonicum* belong to the tulip family that includes other important and well-known species such as Garlic, onions and leek.⁸

These plants have nutritional and pharmaceutical applications all over the world and are rich in flaunol and organophosphorus compounds.^{8,9} The onion of the shallot is used for the treatment of rheumatism, superficial wounds, and sputum. It is prominently used in the food industry as a flavoring material.¹⁰ Artichoke with the scientific name of *Cynara scolymas* L. belongs to the Asteraceae family and it is called Artishu or Arde Shahi (*Cynara scoolymus*) in the Persian language. Therapeutic effects of artichoke include anti-microbial effects, supporting liver effects, and decreasing effects of the cholesterol and blood fat. This study aims to investigate the antifungal effects of the extracts of the shallots and artichokes on *C. albicans*.

METHODS

After collecting the plants, they are rinsed with water and chopped for the microbial tests. Then they are dried for preparation of the plant extract in the shadow. Shallots and artichokes were collected from the

mountainous regions of Iran, and then they were chopped. For the extract preparation, 10 g dry powder of the plant was placed in half-liter erlens containing 100ml of 96% ethanol and water. The content of erlens was mixed at room temperature for 24 hours by the shaker device with 130 rpm speed, and then was filtered using Whatman paper No. 2. The solvent was separated from the extract by the rotary device and by using the vacuum pump (vacuum distillation). The obtained extract was weighted, and then dissolved in DMSO solvent and it was maintained in the refrigerator at 4 °C to be used.

After sampling the vaginal using the sterile swap and Falcon tube by the gynecological specialists, in these study 30 samples were isolated and transferred to the laboratory and cultivated on agar dextrose saburo and broth dextrose saburo according to the manufacturer's instructions. After the growth of each sample, lam was prepared and the candidate samples were identified and re-cultivated according to standard tables.¹¹

Colonies of *C. albicans* were prepared in the media of agar dextrose saburo at 37°C in homogenous suspension sterile Physiology serum, and the rate of the light passing of the suspension was measured using the spectrophotometry device with 530 nm.

The rate of the passing light of 90% is necessary for preparing a suspension with nearly 10⁶ fungi cells per ml. For determining the inhibitory concentration of the extracts, incubation in media was used (the concentration of 50, 100 and 250 ppm were used). Finally, they were placed in the incubator and the samples were analyzed after 24-48 hours.

RESULTS

The findings revealed that 9 positive cases were detected from among the 30 samples suspect of being exposed to *C. albicans*. The detected samples were exposed to the anti-fungus effects of the

vegetative extract. Our results also revealed that the highest preventive concentration of shallot extract was 250 ppm and three fungi species were blocked in this concentration. On the other hand, the lowest preventive concentration of shallot extract was 250 ppm and two fungi species were blocked in this concentration.

The obtained results showed that the highest preventive concentration for Artichokes plant's extract was 250 ppm and one bacteria species was blocked in this concentration while the highest preventive concentration was 250 ppm and five bacteria species were blocked in this concentration.

The results of the study showed that increased concentration of the extract increased the antifungal effects. The extract of the artichoke had higher inhibitory effect

compared to the extract of the shallot. Moreover, as the extract was decreased the size of the fungi colony was increased too.

Table 1: Minimum concentration inhibitory plant extract against *Candida albicans* (PPM)

Strain of Candida	MIC Shallots	MIC Artichokes
1	50	50
2	100	50
3	250	50
4	250	100
5	100	100
6	100	250
7	100	50
8	50	100
9	250	50

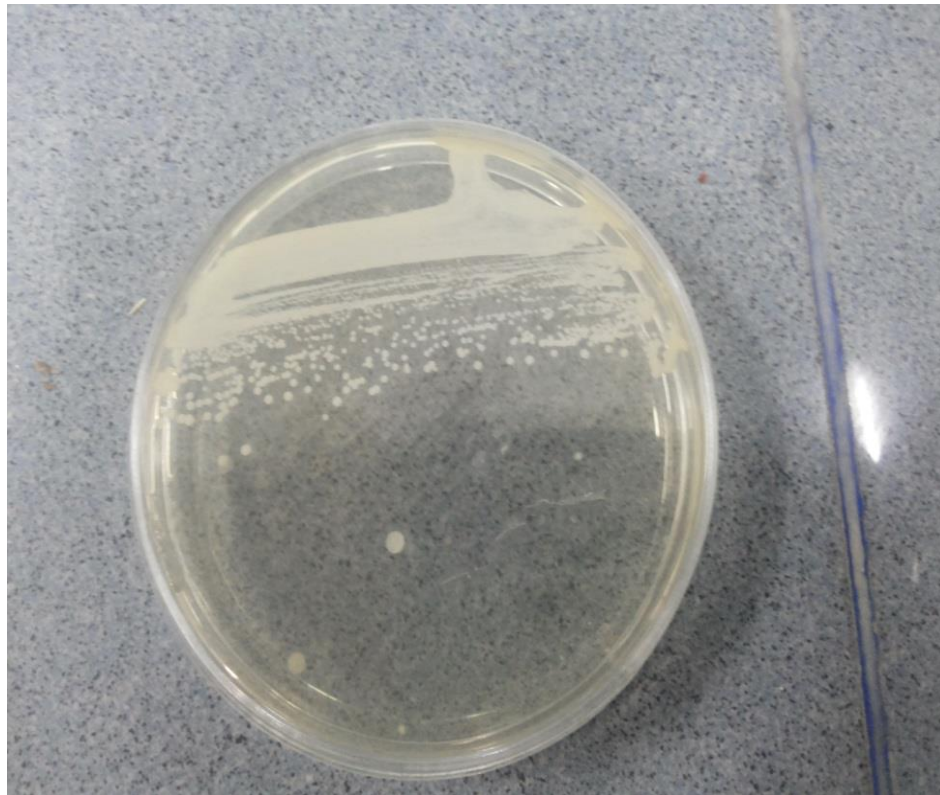


Figure 1: Control sample of *Candida albicans* without the extract

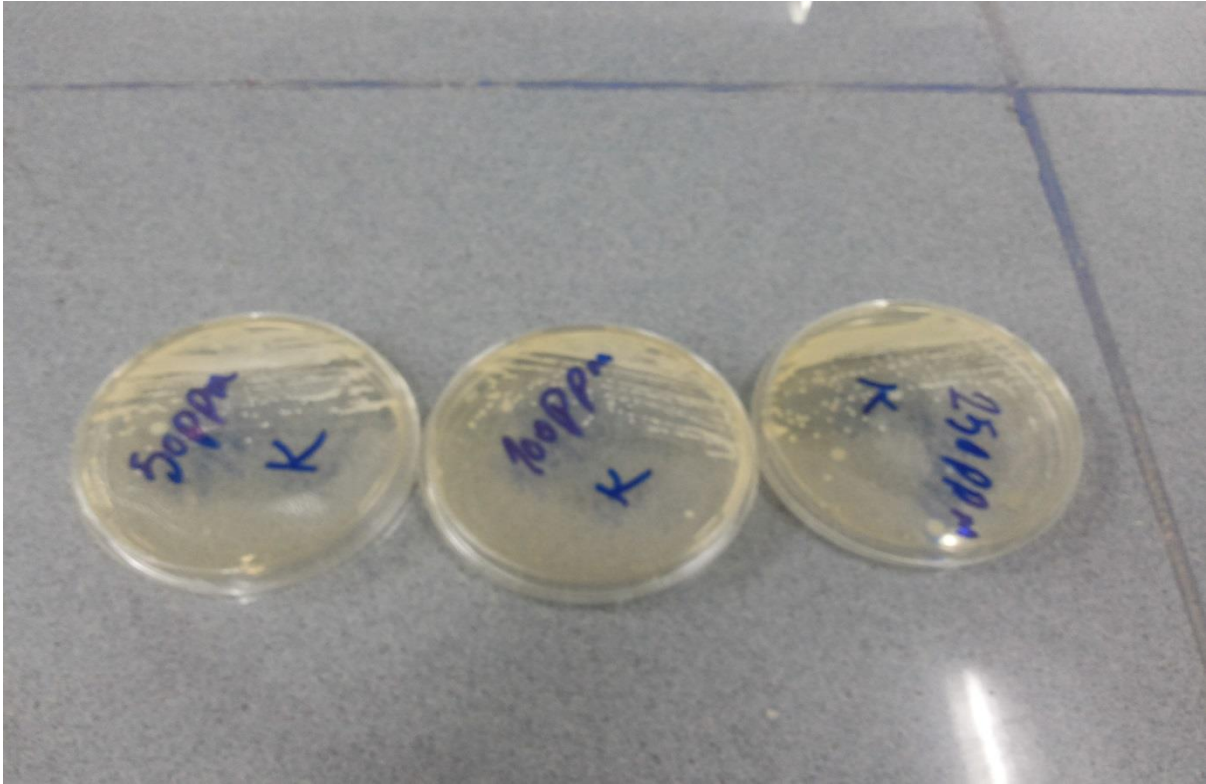


Figure 2: A sample of *Candida albicans* with different extract concentrations of the artichokes

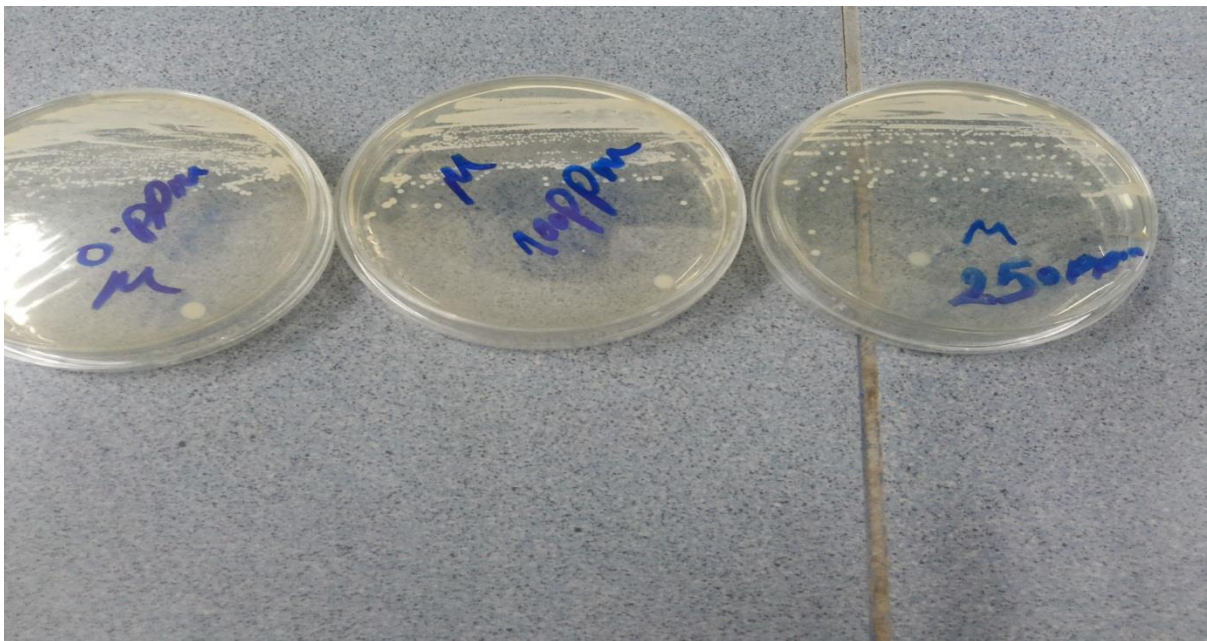


Figure 3: A sample of *Candida albicans* with different extract concentrations of the shallot

DISCUSSION

With the emergence of different fungal species, resistant to the anti-fungal compounds, including *Candida*, Dermatophyte, and *Cryptococcus neoformans*; scholars are trying to develop new therapy methods with less toxic effects of the fungus treatment for humans.

A study by Falahati showed that the minimum inhibitory concentration (MIC) of the ethanoic and aqueous extract of the shallot compared with the *C. albicans* has been 0.05-3.2, 12.8-25.6 mg/ml.¹²

A study by Gharib Nasery and Zarei Mahmoudabadi, indicated that the maximum inhibitory zone diameter at concentrations of 1% was 27 mm; however, the maximum inhibitory zone diameter at concentrations of 5% was 23mm that were formed in four directions of this diameter 1% diameter equal to 27 mm has been while most inhibitory at concentrations of Halo 5.0% equal to 23 mm diameter.¹³

A study by Dalirsani showed that the inhibitory zone diameter of the garlic extract was 18.64 compared to that of *C. albicans*.¹⁴

Naganawa and Iwata, considered the sulfur-containing compounds in garlic as a strong antimicrobial factor against the activities of *Klebsiella pneumoniae* and *Escherichia coli*.¹⁵

A study by Arbabian revealed that the inhibitory zone diameter of the ethanolic extract of the leaves, stems and flowers of artichoke has been 12, 5.11 and 10 menstruation, respectively, compared to those of *C. albicans*.¹⁶

Moslemi et al. investigated the anti-fungal effect of various plant extracts of *Ephedra pachyclada* on the *C. albicans* and showed that the minimum inhibitory concentrations of Chloroform Fraction, aqueous fraction, methanolic fraction, and total methanolic extract have been 5, 1.25, 1.25, and 2.5 mg/ml, respectively.

CONCLUSION

Due to the inhibitory effect of extracts of the shallots and artichoke on the *C. albicans* for using the extracts of these plants, further research on and investigation of the effective chemicals are proposed.

CONFLICT OF INTEREST

All authors disclose any financial and personal relationships with other people or organizations and the authors declare that there are not any potential conflicts of interest. I indicate here that any color photo in print is required. The authors declare no conflict of interest.

ACKNOWLEDGMENT

The authors thank Mrs. Hamideh Khajeh, Laboratory experts of institute of plant biotechnology in the University of Zabol for supplying required instruments.

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How to cite the article: Mashhadi MA, Fakheri BA, Saeidi S. Antifungal effects of the extracts of the shallots and artichokes on *Candida albicans*. *Adv Herb Med.* 2016; 2(1): 38-43.