Comparison of Antibacterial Effect of Cichorium intybus L. with Vancomycin, Ceftriaxone, Ciprofloxacin and Penicillin (In Vitro)

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Abstract

Background and aim: Although antibiotics are used in the treatment of infectious diseases nevertheless, there are many problems such as adverse drug reactions and resistance to antibiotics. Plants, which may have less adverse reactions, can be suitable substitute for chemical drugs. Cichorium intybus L, which is one of the herbs that can be easily found in many areas of Iran, has antibacterial effect and can be used in the treatment of infectious diseases. The present study was planned for comparison of antibacterial effect of Cichorium intybus L. with vancomycin, ceftriaxone, ciprofloxacin and penicillin.

Methods: In the present experimental study Streptococcus pyogen, Staphylococcus aureus and Enterococcus were cultured on blood agar medium. Alcoholic extract of Cichorium intybus L. (AEI) was added to culture media along with antibiotics (vancomycin, ceftriaxone, ciprofloxacin and penicillin) discs. Zone of inhibition of samples were measured and the data was analyzed by using Chi square and Fisher’s exact tests.

Results: AEI had no antibacterial effect on Enterococcus. Ceftriaxone had antibacterial effect on Enterococcus and Streptococcus pyogen with no effect on Staphylococcus aureus. Ciprofloxacin had antibacterial effect on Enterococcus and Staphylococcus aureus and Penicillin had only effect on Streptococcus pyogen.

Conclusion: AEI had no antibacterial effect on Streptococcus pyogen, Staphylococcus aureus and Enterococcus. We conclude that other extracts of Cichorium intybus L. such as aqueous or ethyl acetate may have antibacterial effect on gram positive bacteria which requiring more studies to prove.

Keywords: Ceftriaxone; Cichorium intybus L; Ciprofloxacin; Penicillin; Vancomycin

Introduction

Incorrect use of antibiotics causes increase of resistance to microorganisms. This not only increase mortality rate but also induce economical damages [1]. Side effects and adverse drug reactions are the biggest problems in the treatment of diseases and are the fourth factor of death in the USA [2,3]. Therefore, actions must be taken to reduce this problem, for example, to develop new drugs, either from synthetic or natural sources [4]. Cichorium intybus L. (Compositae family) is a widespread weed with antibacterial effect. Its habitats are roadsides, railroads and waste grounds, flowering period lasts from June to October. Leaves of the plant contain salts such as sulphates and phosphates of sodium, magnesium and potassium as well as potassium nitrate. It also contains a bitter glycoside named cichorine [5,6]. In traditional medicine, all parts of the plant specially root and leaves are used as diuretic, laxative, antilobulitis, antipyretic, blood purification and strength of the stomach. It is also used as an appetizer as well as in the treatment of hepatic failure, jaundice, intermittent fever and mild states of chronic skin diseases [5].

Penicillins are bacteriocidal antibiotics and are active against gram positive and gram negative microorganisms. Ceftriaxone belongs to the third generation of cephalosporins with increasing effect on gram negative bacteria. Ciprofloxacin is a fluoroquinolone and is mainly used in the treatment of Enterobacter and other gram negative bacillus infectious. Vancomycin is effective against gram positive bacteria in particular Staphylococcus [7]. The objective of present study was comparison of antibacterial effect of alcoholic extract of Cichorium intybus L. (AEI) with vancomycin, ceftriaxone, ciprofloxacin and penicillin against gram positive bacteria in vitro.

Materials and methods

All chemicals used, were of analytical grade. The bacterial species of Staphylococcus aureus, Streptococcus pyogen and Enterococcus were purchased from Pasteur Institute, Tehran, Iran and were cultured on blood agar medium. Leaves of Cichorium intybus L. was collected locally, authenticated by botanist and a voucher specimen preserved at Birjand University of Medical Sciences (BUMS). Then leaves was dried in shade and pulverized to fine particles. The obtained powder was macerated in ethanol 96% for duration of 72 h by shaking the mixture every 12 h. The final extract was passed through No. 1 whatman filter paper and the obtained filtrate was concentrated under vacuum on a rotary evaporator and stored for further use. Three concentrations of the extract containing 10%, 15% and 20% were prepared in sterile distilled water and ethanol with the proportion of nine to one respectively.

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The antibacterial activity of samples was determined by well and disc diffusion methods by some modifications [8,9]. A suspension of 0.5×10^8 microorganism per mL of three bacteria including Streptococcus pyogen, Staphylococcus aureus and Enterococcus were prepared. The obtained suspensions with the turbidity of 0.5 McFarland were spread on the plates containing blood agar. Then seven wells with the diameter of 6 mm were made on the plate with the distance of at least 2 cm from each other and 1.5 cm from the edge of culture medium. On each plate one well for negative control and for each concentration of AECI, two wells were used. The experiment was carried out 15 times for each microorganism. The discs of four reference antibiotics including vancomycin, ceftriaxone, ciprofloxacin and penicillin purchased from Padtan, Tehran Teb Company were also placed on the cultured plates. In this case for each microorganism, it was performed six times. All the plates were incubated at 37°C for 24 h and antibacterial activity was evaluated by measuring the diameter of the inhibition zone in mm. According to the report of NCCLS the zone of inhibition (ZOI) was categorized in to sensitive, semi-sensitive and resistant [10]. Data was collected and analyzed with Chi square and Fisher’s exact test by using SPSS software.

## Results

ZOI of AECI and antibiotics and their sensitivity to microorganisms have been presented in Table 1. In this experimental study, the AECI with three concentrations (10, 15 and 20%) had no effect on Streptococcus pyogen, Staphylococcus aureus and Enterococcus. As, it was shown in Table 2, Vancomycin had antibacterial effect on Staphylococcus aureus and Streptococcus pyogen but no effect on Enterococcus. Ceftriaxone had antibacterial effect on Enterococcus and Streptococcus pyogen with no effect on Staphylococcus aureus. Ciprofloxacin had antibacterial effect on Enterococcus and Staphylococcus aureus and Penicillin had only effect on Streptococcus pyogen.

## Discussion

The AECI in the concentrations of 10%, 15% and 20% did not exhibited any effect on gram positive bacteria including Streptococcus pyogen, Staphylococcus aureus and Enterococcus (five strains for each bacterium), Mosadegh et al. have been indicated that Cichorium intybus L. had partly antibacterial effect on Escherichia coli and Pseudomonas aeruginosa [11]. According to this study Cichorium intybus L. had antibacterial effect on gram negative bacteria whereas our research was on gram positive bacteria. The results obtained from Petrovic et al. displayed that alcoholic, aqueous and ethyl acetate extracts of Cichorium intybus L. had antibacterial effect and in case of ethyl acetate extract this effect was prominent [12]. They had also shown that aqueous extract had antibacterial effect on Pseudomonas aeruginosa. In our study, alcoholic extract of plant was used and may be by using other extracts such as aqueous or ethyl acetate, the same results have been obtained which requiring more studies.

Shirazi et al. [13] studied the antibacterial effect of ten herbal extracts including Glycyrrhiza glabra L., Salvia officinalis L., Myrtus

| Antibiotic       | Concentration | Sensitive (mm) | Semi-sensitive (mm) | Resistant (mm) | Statistical test and significance | Particulars |
|------------------|---------------|----------------|--------------------|----------------|-----------------------------------|-------------|
| ciprofloxacin    | 5 µg          | ≥ 21           | 16-20              | ≤ 15           | X²=83.5, p<0.001                  |             |
| Ceftriaxone      | 30 µg         | ≥ 21           | 14-20              | ≤ 13           | Fisher’s exact test=101.1, p<0.001 |             |
| Penicillin       | 10 unit       | ≥ 29           | --                 | ≤ 28           | Fisher’s exact test=10.09, p<0.003 | When testing staphylococci |
|                  | 10 unit       | ≥ 15           | --                 | ≤ 14           | Fisher’s exact test=10.09, p<0.003 | When testing enterococci |
| vancomycin       | 30 µg         | ≥ 17           | 15-16              | ≤ 14           | X²=61.07, p<0.001                 |             |
|                  | 30 µg         | ≥ 12           | 10-11              | ≤ 9            | X²=61.07, p<0.001                 |             |

### Table 1: Zone of inhibition (mm) according to type of sensitivity.

| Bacterium type | Antibiotics     | Sensitive (no. of strain) | Semi-sensitive (no. of strain) | Resistant (no. of strain) | Total |
|----------------|-----------------|---------------------------|-------------------------------|--------------------------|-------|
| Streptococcus  | Vancomycin      | 3                         | 0                             | 2                        | 5     |
| pyogen         | Ceftriaxone     | 0                         | 1                             | 4                        | 5     |
|                | Ciprofloxacin   | 0                         | 1                             | 4                        | 5     |
|                | Penicillin      | 0                         | 1                             | 4                        | 5     |
|                | AECI (10, 15 and 20%) | 0           | 0                             | 15                       | 15    |
|                | Ethanol 96%     | 0                         | 0                             | 15                       | 15    |
| Staphylococcus | Vancomycin      | 5                         | 0                             | 0                        | 5     |
| aureus         | Ceftriaxone     | 0                         | 0                             | 5                        | 5     |
|                | Ciprofloxacin   | 0                         | 2                             | 3                        | 5     |
|                | Penicillin      | 0                         | 5                             | 5                        | 5     |
|                | AECI (10, 15 and 20%) | 0           | 0                             | 15                       | 15    |
|                | Ethanol 96%     | 0                         | 0                             | 15                       | 15    |
| Enterococcus   | Vancomycin      | 0                         | 0                             | 5                        | 5     |
|                | Ceftriaxone     | 5                         | 0                             | 0                        | 5     |
|                | Ciprofloxacin   | 5                         | 0                             | 0                        | 5     |
|                | Penicillin      | 0                         | 0                             | 5                        | 5     |
|                | AECI (10, 15 and 20%) | 0           | 0                             | 15                       | 15    |
|                | Ethanol 96%     | 0                         | 0                             | 15                       | 15    |

### Table 2: Comparison of in vitro antibacterial effect of alcoholic extract of Cichorium intybus L. (AECI) with ceftriaxone, ciprofloxacin, penicillin and vancomycin.
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References
1. Frost KJ (2007) An overview of antibiotic therapy. Nurs Stand 22: 51-57.
2. Manasse HR Jr (1989) Medication use in an imperfect world: drug misadventuring as an issue of public policy, Part 1. Am J Hosp Pharm 48: 929-944.
3. Skalli S, Zaid A, Soulaymani R (2007) Drug interactions with herbal medicines. Ther Drug Monit 29: 679-686.
4. Nascimento GGF, Locatelli J, Freitas PC, Silva GL (2000) Antibacterial activity of plant extracts and phytochemicals on antibiotic-resistant bacteria. Braz J Microbiol 31: 247-56.
5. Zargari A (1996) Medicinal plants. (6th edn), Institute of Tehran University Press and Publications: Tehran, Iran.
6. Judzentiene A, Budiene J (2008) Volatile constituents from aerial parts and roots of Cichorium intybus L. (chicory) grown in Lithuania. Chemija 19: 25-28.
7. Behnood S (2002) Katzung and Trevor,s Pharmacology. (1st edn), Tajmouzadeh Publications: Tehran, Iran. 158-160.
8. Mosquera OM, Correa YM. Niño J (2004) Antibacterial activity of some Andean Colombian plants. Pharm Biol 42: 499-503.
9. Zargar M, Correa YM, Buitrago DC, Niño J (2007) Antioxidant activity of twenty five plants from Colombian biodiversity. Mem Inst Oswaldo Cruz 102: 631-634.
10. Wistreich GA (1997) Microbial laboratory, Fundamentals and Applications. (6th edn), Prentice-Hall, USA: 324.
11. Mostadeghi M, Sharifabadi A, Nasiri P (2002) Phytochemistry survey and antibacterial effect of Cichorium intybus L. and Teucrium polium and assessment of their antibacterial and antifungal effects. Scientific journal of KUMS 25: 1-6.
12. Petrovic J, Stanogovic A, Comic Lj, Curcic S (2004) Antibacterial activity of Cichorium intybus. Fitoterapia 75: 737-739.
13. Shirazi MH, Fazeli MR, Soltan Daftal MM, Eshraghi S, Jamalifar H, et al. (2003) Study of ten herbal extracts on Helicobacter pylori and comparison of them with antibiotics. Journal of medicinal plants 7: 53-60.
14. Zyaei SA, Hamkar R, Monavari HR, Nowruz Z, Adibi L (2006) Evaluation of antiviral effects of twenty medicinal plants. Journal of medicinal plants 6: 1-9.
15. Makarem A, Khordi Moud M, Poureslami HR, Agami B (2002) The effect of toothpaste containing herbal extracts on controlling of plaque and gingivitis. Journal of EUMS 7: 246-52.
16. Aqil F, Ahmad I (2007) Antibacterial properties of traditionally used Indian medicinal plants. Methods Find Exp Clin Pharmacol 29: 79-92.