ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES OF DIFFERENT PLANTS EXTRACTS AGAINST STAPHYLOCOCCUS AUREUS ISOLATED FROM SOCCER PLAYER’S SHOES AND KNOWLEDGE AND APPLICATIONS ABOUT FOOT HYGIENE OF THE SOCCER PLAYERS

A.S. Okmen*

Mugla Sitki Kocman University, Faculty of Education, Primary Education, Class Teacher Department, Kotekli, Mugla, 48000, TURKEY.

*E-mail: sadanokmen@gmail.com.

Abstract

Background: Microorganisms most commonly attack the feet. Bacteria have an easier entry into the athlete’s epidermis. Staphylococcus aureus, commonly found on the skin or in the nose. The purpose of the study was to report the lack of knowledge on the antibacterial and antioxidant effects of different plants extracts and to report existing knowledge on hygiene of sports equipment and that of soccer players.

Materials and Methods: The bacteria were isolated from soccer player’s shoes (n=28) from Balikesir Spor soccer team after the competition. Additionally, ten plants were collected from Mugla, Hatay, and Hakkari in Turkey. In antibacterial activity studies, the plant materials were tested by disc diffusion assay. Furthermore, the different plants extracts were studied by ABTS decolorisation assay.

Results: The highest antibacterial activity was shown on S. aureus - BFT2 (22 mm) for Hypericum perforatum L. subs. veranese (Schrant) H. Lindb. The different extracts possessed antibacterial activity, and showed MIC effect at 812.5 µg/mL. The antioxidant activities by ABTS assay were in the order of Arbutus andrachne (flower) > Arbutus andrachne (leaf) > Anemhis sp. (flower) > Crepis sancta L. (leaf) > Allium sphaerocephalon (root) > Plantago major (leaf) > Lavandula stoechas (flower) > Anemhis sp. (flower) > Urtica dioica (leaf) > Lavandula stoechas (leaf) > Anemhis sp. (leaf) > Hypericum perforatum L. subs. veranese (Schrant) H. Lindb (flower) > Anemhis chia L. (leaf).

Conclusion: Different plant extracts have antimicrobial and antioxidant potential.

Key words: Soccer player, hygiene, Staphylococcus aureus, medicinal plant, antibacterial, antioxidant

Introduction

Sports medicine topics tend to focus on physiological (cardiovascular, neural, muscular etc.) problems of athletes, yet the most common sports injuries are dermatologic in nature (Adams, 2006). This article will highlight bacterial infections common to shoes of soccer players. Bacteria have an easier entry into the athlete’s epidermis due to sweat saturation (which causes super saturation and vulnerability of the stratum corneum), skin traumabrasions, and occluding athletic gear that can provide a warm, moist environment for bacterial growth. In the early 1960s, an antibiotic resistant strain of S. aureus known as MRSA was described (Barrett et al., 1968; Rihn et al., 2005a). Methicillin-resistant S. aureus has acquired the mecA gene (Ma et al., 2002; Naimi et al., 2003), and is resistant to β-lactam antibiotics, including penicillins and cephalosporins (Fridkin et al., 2005; Crawford et al., 2007; Daum, 2007) although resistance to other classes of antibiotics, such as fluoroquinolones and tetracyclines, is increasing (Frazier et al., 2005; Fridkin et al., 2005; Gorwitz et al., 2006) Until recently, MRSA was thought to be exclusively a hospital-acquired infection (Fridkin et al., 2005; Turbeville et al., 2006; Daum, 2007). In the mid- to late 1990s, however, MRSA infections started to be detected in the community outside the typical health care settings (Naimi et al., 2003 Turbeville et al., 2006; Daum, 2007; Klevenos et al., 2007), being diagnosed in soccer players participating in football (CDC, 2003; Begier et al., 2004; Rihn et al., 2005b), wrestling, (Lindemayer et al., 1998) and fencing (CDC, 2003), where as many as 70% of team members required hospitalization and intravenous antibiotic therapy (CDC, 2003; Rihn et al., 2005a). When a MRSA infection occurs in the community it is called community-associated MRSA, or CA-MRSA. Infections caused by CA-MRSA appear to be more common than those caused by Staph in the past, particularly in amateur and professional athletic teams.

If proper hygienic practices are followed, this risk can be greatly reduced. There are different steps that soccer players can take to help prevent MRSA. Athletes can be educated and informed about hygiene and hygiene of sports equipments used in training and competition. However we know that hygiene comes from family and goes on the school. Therefore, the education of hygiene should start at kindergarten, elementary and secondary school. Because of the lack of hygiene, scientists have turned within quest for new approaches to the treatment of these infections recently.

Medicinal plants represent a rich source of are antimicrobial agents. These plants are used medicinally in different countries and are a source of many potent and powerful drugs (Srivastava et al., 1996). According to World Health Organization, medicinal plants would be the best...
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source to obtain a variety of drugs. Therefore, such plants should be investigated to better understand their properties, safety and efficacy (Nascimento et al., 2000). Many plants have been used due to their antimicrobial traits.

The antimicrobial activity of medicinal plants extracts against *Staphylococcus aureus* isolated from athlete’s shoes has not been studied, before that the *in vitro* antimicrobial activity of various parts of different plants growing in Turkey was evaluated using disc diffusion method. Additionally, antioxidant activities of medicinal plants extracts have not been reported. This work attempts to contribute to this lack of knowledge about the antimicrobial and antioxidant effects of different plants extracts and to search the knowledge about hygiene and hygiene of sports equipment that is used in the competition by athletes, of soccer players and what they do about the hygiene.

**Material and Methods**

**Questionnaire**

The study included 28 male professional (division III) soccer players (age: 16.86±0.86 years). All of the participants were fully informed of the goals and methodology of the test and provided signed consent. The participants agreed with the testing process and the use of the data for further research. Prior to participation in the study, the players were interviewed about their medical records and completed an questionnaire about hygiene and sports equipment.

**Sample Collection**

**Organisms**

A total of 28 soccer players (swabs from the shoes after competition) positive for Gram positive cocci were included. Specimens were collected from soccer players after competition at Balikesir Spor soccer team (U-16 and U-17) in Balikesir, Turkey in 2014. Specimens were collected aseptically, transported immediately to the Microbial Biotechnology Laboratory of the Department of Biology, Mugla Sitki Kocman University, Turkey, the tests were performed. They were stored at 4°C and analysed within 24 hours.

**Plant materials**

The plants were collected in May between July 2013 from Mugla, Hatay and Hakkari in Turkey. Ten plants were used in this study. These species including; *Hypericum perforatum* L. subsp. *veranese* (Schrant) H. Lindb., *Plantago major*, *Urtica dioica*, *Arbutus andrachne*, *Anthemis sp.*, *Allium sphaerocephalon*, *Anthemis chia* L., *Crepis sancta* L., and *Lavandula stoechas*. The identity was confirmed by Dr. Olcay CEYLAN, Department of Biology, Mugla Sitki Kocman University. The plant materials were deposited at the Herbarium of Department of Biology, Mugla Sitki Kocman University. The identification of these specimens was carried out using the Flora of Turkey (Davis, 1975).

**Isolation of Organisms**

The spread-plate method was used for isolating pure cultures. The organisms were isolated from soccer player’s shoes in Balikesir Spor (U-16 and U17) soccer team. Samples (28 swabs) were aseptically collected and spread on agar plates using a drigalski spatula. The plates were incubated at 37°C for 24 hours. The species include; six *S. aureus*. The bacteria were grown for 24h at 37°C in Mueller- Hinton Broth (Merck).

**Identification of Isolated Organisms using Conventional Tests**

Isolates were incubated at 37°C for 18- 24 hours on Mueller- Hinton Broth (Merck). Bacterial identifications were studied by conventionally methods by Dr. Gulten OKMEN. The identification of microorganisms was based on such tests as: Gram reaction, colonial morphology, cell morphology, and biochemical tests. Gram staining was carried out on presumptive isolates. Single colonies of Gram positive cocci were then tested with catalase test, coagulase test, pigment production, and growth on Mannitol salt agar (MSA). Sequel testing of the isolates was further performed beginning with MSA, followed by finally Tube Coagulase Test, to evaluate the performance of individual tests. Results were confirmed using manual for determinative bacteriology (Cowan and Steel, 1965; Monica, 1991).

**Enumeration of Total Bacteria Number**

Plate count method was used to estimate the total number of bacteria on a solid medium containing Plate Count Agar. Total aerobic bacterial counts of swabs were determined by the incubation of all the inoculated plates at 37°C, and colonies were counted using colony counter (Funke GERBER) at 24 h after inoculation (Atlas, 2004).

**Determination of Bacterial Flora**

In this study, samples were taken from 28 athlete’s shoes from Balikesir Spor soccer team (U-16 and U-17), TURKEY. Bacteria were isolated from these samples. To identify purified isolates to genus or species level, basic tests, namely Gram’s stain, morphology, catalase, pigment production, and growth on MSA, were performed following the criteria described in the *Bergey’s Manual of Systematic Bacteriology* (Holt et al., 1994).

**Plant extraction**

The plant materials were washed thoroughly 2-3 times with running water and once with sterile distilled water. Fresh plant materials were air-dried, and then the dried materials were powdered in a blender. All samples were stored at ambient temperature until initial sample preparation, after which they were stored at 4°C until required for analysis. The air dried and powdered samples were extracted with methanol.
The extracts of plants were individually tested against *Staphylococcus aureus*. Kirby-Bauer method applied for antibacterial activity. The plant materials were tested by disc diffusion assay. The concentration and quantity of extracts were used as 40 µL of 100 mg/mL. Methanol was used in this study. The bacteria were maintained on Mueller-Hinton agar plates (MHA, Merck) at 37°C (Bauer *et al*., 1966). The cultures adjusted 0.5 McFarland. The experiments were performed in triplicate. Bacteria were incubated at 37°C in 24 hr. After incubation, the inhibition zones formed and then the values of zone were measured. Methanol used as negative control. Oxacillin (5 µg), Vancomycin (30 µg), and Erythromycin (15 µg) antibiotics used as positive control.

### Determination of minimum inhibitory concentration (MIC)

The MIC was evaluated on plant extracts as antimicrobial activity. The MIC was taken as the lowest concentration that inhibits growth after incubation. The broth dilution assay was performed as described in the CLSI standards (CLSI, 2003; CLSI, 2006). This test was performed at final concentrations of each extract (6500; 3250; 1625; 812.5; and 406.25 µg/mL).

### In vitro Antioxidant Activity

The experiments were carried out using an improved ABTS decolourisation assay (Re *et al*., 1999). The stock solutions included 7 mM ABTS⁺ [2,2’-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid)] solution and 2.45 mM potassium per sulfate solution. The working solution was then prepared by mixing the two stock solutions in equal quantities and allowing them to react for 12 hr at room temperature in the dark. The solution was then diluted by mixing 1 mL ABTS⁺ solution with 10 µL methanol. Absorbance was measured 15 min after the initial mixing of 10 µL of the methanolic extracts with 1 mL of ABTS⁺ solution. Then the absorbance was taken at 734 nm using the spectrophotometer (Shimadzu UV–1201, Japan). Trolox (6-hydroxy-2,5,7,8-tetramethoxychroman-2-carboxylic acid; Sigma Chemical Co. St. Louis, MO, USA) was used as a reference standard. Results are expressed in mM Trolox equivalents (TE)/g dry mass. The scavenging capability of ABTS⁺ radical was calculated using the following equation:

$$\text{ABTS scavenging effect} (\%) = \left(\frac{1}{A_0/A_1}\right) \times 100$$

where $A_0$ is the initial concentration of the ABTS⁺ radical cation (s) and $A_1$ is absorbance of the remaining concentration of ABTS⁺ radical cation (s) in the presence of the extract.

### Table 1: Properties of yellow bacteria isolated from athlete’s shoes

<table>
<thead>
<tr>
<th>isolates</th>
<th>bacteria frequency (%)</th>
<th>catalase activity</th>
<th>mannitol fermentation</th>
<th>yellow pigment production</th>
<th>numbers of total bacteria in shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram (+) cocci</td>
<td>69</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Gram (-) cocci</td>
<td>23</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Gram (+) bacil</td>
<td>2</td>
<td>NA</td>
<td>-</td>
<td>+</td>
<td>1140</td>
</tr>
<tr>
<td>Gram (-) bacil</td>
<td>6</td>
<td>NA</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>S. aureus</td>
<td>11</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

(-): Not fermented (+): Fermented NA: No activity

### Table 4: Trolox equivalents of antioxidant activities of different plants extracts

<table>
<thead>
<tr>
<th>Plants extracts (100mg/mL)</th>
<th>HP</th>
<th>PM</th>
<th>UD</th>
<th>AA</th>
<th>CS</th>
<th>LS</th>
<th>LS</th>
<th>TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(flower)</td>
<td>0.59</td>
<td>1.58</td>
<td>0.86</td>
<td>1.88</td>
<td>2.25</td>
<td>1.02</td>
<td>0.79</td>
<td>1.86</td>
</tr>
</tbody>
</table>


**Figure 1:** Non-enzymatic antioxidant activities of different plants extracts

Table 2: Antibacterial activities against isolated *S. aureus* of different plants extracts

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Plant extracts (100 mg/mL)</th>
<th>Antibiotics</th>
<th>Negative control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HP (flower)</td>
<td>PM (leaf)</td>
<td>UD (leaf)</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT1</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT2</td>
<td>22</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT3</td>
<td>19</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT4</td>
<td>18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT5</td>
<td>17</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT6</td>
<td>16</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

HP: *Hypericum perforatum* L. subsp. *veranese* (Schrant) H. Lindb.; PM: *Plantago major*; UD: *Urtica dioica*; AA: *Arbutus andrachne*; As: *Anthemis sp.*; AS: *Allium sphaerocephalon*; AC: *Anthemis chia* L.; CS: *Crepis sancta* L.; LS: *Lavandula stoechas* (-): No inhibition; O: Oxacillin (5 µg); V: Vancomycin (30 µg); E: Erythromycin (15µg); M: Methanol (25µL)

Table 3: Minimum inhibitory concentrations of different plants extracts (µg/mL)

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>HP (flower)</th>
<th>PM (leaf)</th>
<th>UD (leaf)</th>
<th>AA (leaf)</th>
<th>AA (flower)</th>
<th>As (flower)</th>
<th>As (flower)</th>
<th>As (root)</th>
<th>AC (leaf)</th>
<th>CS (leaf)</th>
<th>LS (leaf)</th>
<th>LS (flower)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>S. aureus</em> BFT1</td>
<td>6500</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>3250</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT2</td>
<td>3250</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>812.5</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>812.5</td>
<td>NT</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT3</td>
<td>3250</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT4</td>
<td>812.5</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT5</td>
<td>1625</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>3250</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
</tr>
<tr>
<td><em>S. aureus</em> BFT6</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
<td>1625</td>
<td>NT</td>
</tr>
</tbody>
</table>

Results

Participants (age: 16.86±0.86 years) filled out a Questionnaire about the hygiene and the life style of soccer players. It shows that their mother’s and father’s education level are primary school (57%) and senior high school (43%) respectively. Most of the participants live in city centre (72%). They do exercise 6 days in a week (80%) regularly and have played soccer for 3-7 years (47%) and for 7-11 years (47%). Fifty percent of the participants haven’t been educated about hygiene.

Firstly, bacteria isolated from the 28 athlete’s shoes after competition were performed Gram staining. Gram-positive cocci separated and the biochemical tests were performed. Especially, biggest problem in contact sports is antibiotic-resistant S. aureus and these bacteria were studied for identification. In this study, total 1140 bacteria were isolated from 28 player’s shoes. Gram positive cocci were inoculated on MSA medium, 58 yellow pigment-producing bacteria have been selected randomly at the end of the incubation period. 69% of these bacteria are Gram-positive cocci. 11% of Gram-positive cocci are S. aureus. The other bacteria include; 23% Gram negative cocci, 2% Gram positive bacilli, 6% Gram-negative bacilli. Catalase and mannitol fermentation tests were applied to yellow pigment-producing bacteria. Then, catalase-positive and mannitol fermenting- bacteria were selected. At the end of biochemical processes were isolated 6 S. aureus strains. Further studies were carried out with these six bacteria (Table 1).

The results of antibacterial activities were measured as zone of inhibition in mm for all the materials used as follows. The antibacterial activities of plants extracts were evaluated in vitro against 6 Staphylococcus aureus. Results of antibacterial activities of methanol extracts of used plants against the test bacteria are shown in Table 2. The highest antibacterial activity was shown on S. aureus BFT2 (22 mm) for Hypericum perforatum L. subsp. veranense (Schrant) H. Lindb.

Results show that, the methanol extracts of 8 plants inhibited the growth of bacteria and the inhibition zones ranged between 10- 22 mm. In addition to, the extracts of 5 plants did not determine any antibacterial effects against used 6 bacteria. These bacteria were found resistant to all of extracts. The lowest activity was found as 10 mm. 3 antibiotics used as positive control. These include; oxacillin, vancomycin, and erythromycin. Methanol used as negative control. Data of antibacterial activities of the extracts are demonstrated in Table 2.

Antibacterial activity studies have been tested against pathogens by using broth dilution method. In Table 3, MIC values of methanol extracts belong to leaves, flowers, and root of ten plants were summarized. MIC values for plant extracts were applied from 6500 to 406 μg/mL. S. aureus BFT4 have shown the lowest sensitivity to Hypericum perforatum flower extract. S. aureus BFT2 have shown the lowest sensitivity to two extracts. These include; Anthemis sp. leaf and Lavandula steochas leaf extracts. However, S. aureus BFT3 have found the lowest sensitivity to Lavandula steochas flower extract. These extracts of different plants possessed antibacterial activity, and showed minimal inhibitory concentration effect at 812.5 μg/mL.

ABTS free radical scavenging method was used for antioxidant activity. The results of ABTS scavenging assay of different plants extracts are shown in Table 4 and Figure1. Table 4 and Figure1 show the per cent of ABTS radical scavenging capacity with trolox as reference. Arbutus andrachne flower extracts showed 82% inhibition at 100 mg/mL concentration. Whereas, the lowest activity was found by Anthemis chia (Table 4 and Figure1). The antioxidant activity by ABTS assay were in the order of Arbutus andrachne (flower) > Arbutus andrachne (leaf) > Anthemis sp. (flower) > Crepis sancta (leaf) > Allium sphaerocephal (root) > Plantago major (leaf) > Lavandula steochas (flower) > Anthemis sp. (flower) > Urtica dioica (leaf) > Lavandula steochas (leaf) > Anthemis sp. (leaf) > Hypericum perforatum (flower) > Anthemis chia (leaf) (Table 4 and Figure1).

Discussion

This study confirms that the leaf, root and flower of different plants possess antimicrobial and antioxidant activities. The properties commonly found in the plants, and have been reported to posses multiple biological effects including antimicrobial and antioxidant activities. In this study, the antibacterial activity for methanolic extract was also high against the one tested pathogens, results indicated the polarity of the solvent plays an important role in the extraction of the active ingredient and consequently on its antimicrobial activity. http://www.ingentaconnect.com/content/ijapf/ipf/1995/0000000580/00000003/art00010In this study, the highest antibacterial activity was showed as 22 mm against S. aureus BFT2 for Hypericum perforatum flower extract (Table 2). In Gram-positive bacteria, cell wall allows the essential oil and hydrophobic constituents to be in direct contact with the phospholipid bilayer of the cell membrane. Researchers reported that where they bring about their effect, causing either an increase in ion permeability and leakage of vital intracellular constituents, or impairment of the bacterial enzyme systems (Ratledge and Wilkinson, 1988; Wendakoon and Sakaguchi, 1995). Dua et al. (2013) reported that antibacterial activities of Foeniculum vulgare Miller seeds were found as 11 mm inhibition zone against S. aureus (Dua et al., 2013). This report also supports the results we obtained from our study.

In this work, the inhibition zone was not produced by some of extracts against test organisms (Table 2). These include; Urtica dioica (leaf), Arbutus andrachne (leaf), Anthemis sp. (flower), Allium sphaerocephal (flower), and Allium sphaerocephal (root). Abuhmadah et al. (2013) reported that the extract of A. andrachne was not inhibited three test bacteria. This research supports the results we obtained from our study. According to our results, the extracts from different plants possessed antibacterial activity, and showed minimal inhibitory concentration effect at 812.5 μg/mL (Table 3). These include; Hypericum perforatum (flower), Anthemis sp. (leaf), Lavandula steochas (leaf), and Lavandula steochas (flower). Previous antibacterial studies of Arbutus pavarri indicate that methanolic extract exhibited antibacterial effect against S. aureus, with zone of inhibition of 20 mm, and the minimum inhibitory concentrations were 4.86 mg/mL. (Alsabri et al., 2013). In this study, MIC value was generally measured as 812.5 μg/mL, and our results are better than those of Sharma et al. (2004) and Alsabri et al. (2013). Excessive production of free radicals has been noted to cause damage to biological material leading to several physiological and pathological abnormalities an essential event in the etiopathogenesis of various diseases (Sakanaka et al., 2005; Alothman et al., 2009; Hasan et al., 2012; Keser et al., 2012). The results of ABTS scavenging assay of different plant extracts are shown in (Table 4 and Figure1). Arbutus andrachne (flower) methanol extract showed 82% inhibition at 100 mg/mL concentration (Table 4 and Figure1). The antioxidant activity by ABTS assay were in the order of Arbutus andrachne (flower) > Arbutus andrachne (leaf) > Anthemis sp. (flower) > Crepis sancta (leaf) > Allium sphaerocephal (root) > Plantago major (leaf) > Lavandula steochas (flower) > Anthemis sp. (flower) > Urtica dioica (leaf) > Lavandula steochas (leaf) > Anthemis sp. (leaf) > Hypericum perforatum (flower) > Anthemis chia (leaf). A. andrachne was found to be the highest among 51 other medicinal plant species in Jordan that have antioxidant content (Tawaha et al., 2007). Phytochemical studies have shown that the leaf extract contains phenolic antioxidant compounds, such as flavonoids (Mazza and Miniai, 1993; Males et al., 2006), tannins, phenolic
Conclusion

Medicinal plants had good antibacterial action on all test organisms, further investigation is necessary for possible use of the active component in chemotherapy. Our results suggest that *Hypericum perforatum* has significant antibacterial activity and could be very useful in the discovery of novel antibacterial agents of plant origin. Further phytochemical studies are required to determine and isolate compounds responsible for the antibacterial effects of these species. In conclusion, medicinal plants might be considered as a potential source of metabolites which could be developed as precursors for antimicrobial and antioxidants drugs. The results in this study using ABTS method to evaluate the antioxidant showed that the *Hypericum perforatum* and *Arbutus andrachne* extracts can be considered good sources of natural compounds with significant antioxidant activity. Consumption of microbiologically safe plants should be encouraged for their rich antioxidants.

Soccer players and their families should be educated about hygiene, dermatological problems and bacteria damages in sports. Mother’s and father’s education level should be increased and they informed about cleaning, hygiene and sanitation. Result of that the best treatment for bacterial and dermatological conditions is prevention.

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References


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glycosides, anthocyanins, gallic acid derivatives etc. (Hertog et al., 1992; Ayaz et al., 2000; Kivcak et al., 2001a; Kivcak et al., 2001b; Fabuccuoglu et al., 2003; Fiorentino et al., 2007).

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