SCREENING OF ANTIBACTERIAL ACTIVITY OF FIVE DIFFERENT SPICES (AJWAIN, CORIANDER, CUMIN, FENNEL, AND FENUGREEK) AGAINST PATHOGENIC BACTERIAL STRAINS.

SALMA S*, LALITHA RAMAKRISHNAN, VINOTHINI J

Department of Nutrition and Dietetics, PSG College of Arts and Science, Affiliated to Bharathiar University, Coimbatore, Tamil Nadu, India. Email: smartsalma@outlook.com

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ABSTRACT

Objective: This study was focussed on an evaluation of antibacterial activities of aqueous and alcoholic extracts of commonly consumed spices, namely, Ajwain (Trachyspermum ammi), Coriander (Coriandrum sativum), cumin (Cuminum cyminum), fenel (Foeniculum vulgare), and Fenugreek (Trigonella foenum-graecum).

Methods: This study includes the antibacterial effects of spices against six bacterial strains, namely, Escherichia coli, Klebsiella pneumonia, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella typhi, and Staphylococcus aureus to compare their antibacterial effects by the paper disc agar diffusion method with three antibiotics such as amikacin, chloramphenicol, and vancomycin.

Results: According to findings, it is determined that inhibitory activity was detected on aqueous and alcoholic extracts of Ajwain, aqueous extract of cumin and on alcoholic mixed spice sample.

Conclusions: Among the five spices tested, only aqueous extracts of Ajwain and cumin exhibited antibacterial activity against one organism (S. aureus). Comparatively the alcoholic extracts gave a better response than the aqueous extracts. The effectiveness of the antibacterial activity was recorded better for the mixed spice samples when compared to that of the individual spices. This clearly emphasizes that the combined effect of the spices exhibited better antibacterial activity and the kill rate of the bacterial strains is higher relatively.

Keywords: Antibacterial activity, Ajwain, Cumin, Fennel, Fenugreek, Coriander, Bacterial strains.

INTRODUCTION

Infectious diseases are the leading cause of morbidity and mortality worldwide, especially in developing countries. Infectious diseases are caused by microorganisms, such as bacteria, viruses, parasites, or fungi; the diseases that can be spread, directly or indirectly, from one person to another. The emerging of infectious diseases has been recognized as an important outcome of host-pathogen evolution leading to severe public health consequences [1].

Bacterial infections are a worldwide problem. In the past decade antibiotics, resistant infections occurred demanding new therapeutic strategies. For people living in developing countries, mainly medicinal plants and natural substances are available for the treatment of infectious diseases [2,3]. Foodborne pathogens such as Escherichia coli which are widely distributed in nature. It’s implicated in large numbers of foodborne outbreaks in many parts of the world, including the developed countries [4]. The use and knowledge regarding traditional medicine are very diverse, and some traditional medicines were used by women to cure diseases and health care [5].

Early humans recognized their dependence on nature in both health and illness. Led by instinct, taste, and experience, and primitive men and women treated illness using plants [6]. Enormous advances have been made in medical care, but many people are still using herbal or alternative remedies [7].

Over the years and up to date, there have been numerous studies documenting the antibacterial, antifungal, antiviral, anticancer and anti-inflammatory properties of plant ingredients. Therefore, herbal derived substances remain the basis for a large proportion of commercial medications used today in developing countries [8]. This phenomenon has prompted researchers to identify alternative medicines, for the prevention and effective treatment of infections. Plant extracts and biologically active compounds isolated from plants have gained widespread interest, as they have the property to cure a variety of diseases [9].

Many of the spices and herbs used today have been valued for their antimicrobial effects and medicinal powers in addition to their flavor and fragrance qualities. Most of the foodborne bacterial pathogens examined were sensitive to spice extracts. The bacterial examination of spices and condiments are very important as they are used in the food preparation. These spices act through their natural inhibitory mechanisms and either inhibiting or killing the pathogens completely [10].

A spice is a dried seed, fruit, root, bark, or vegetative substance used in nutritionally insignificant quantities as a food additive for the purpose of flavoring, and indirectly for the purpose of killing and preventing the growth of pathogenic bacteria [11].

The organisms never remain the same, and they keep on change their characteristics. Some of the organisms do become resistant to antimicrobial components in the due course. Hence, a detailed study over the antimicrobial properties of spices would help us to know about the effectiveness of their inhibitory properties over certain organisms.

In this study, the antibacterial effects of five widely used spices in India such as Ajwain, coriander, cumin, fennel, and fenugreek were evaluated against the bacterial species such as E. coli, Klebsiella pneumonia, Proteus...
Antimicrobial activity testing using disc diffusion method

The method of testing used for the present study is the disc diffusion method called as Kirby-Bauer method. The Kirby-Bauer method is based on the inhibition of bacterial growth measured under standard conditions. The organism to be tested is grown to a specific turbidity in a standard liquid medium. An inoculum from this culture is spread across the agar surface. The antibiotic in each disc diffuses outward from the disc, and the size of the zone of inhibition is directly proportional to the concentration of the antibiotic and the sensitivity of the organism to the respective antibiotic.

Results and Discussion

This study was conducted to examine the inhibitory effects of spice extracts against some pathogens causing food poisoning and different illnesses in humans and some microorganisms causing spoilage in foods. For this purpose, the aqueous and alcoholic extracts of spices were tested on E. coli, K. pneumonia, S. aureus, P. vulgaris, and S. typhi. The results were compared with the zones of inhibition of test organisms and the results can be interpreted based on the following criteria.

Sensitive

When zone diameter of test organism is greater than or equal to or not more than 4 mm, then the result can be interpreted as sensitive.

Medium sensitive

If the zone diameter is at least 12 mm but reduce in by more than 4 mm.

Resistant

If it shows no zone of inhibition of growth or if zone diameter is not >10 mm.

Table 1: Comparison of antibacterial activity of spices

<table>
<thead>
<tr>
<th>Name of the micro organism</th>
<th>Zone of inhibition (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 µl of aqueous extract</td>
</tr>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>E. coli</td>
<td></td>
</tr>
<tr>
<td>K. pneumoniae</td>
<td></td>
</tr>
<tr>
<td>S. typhi</td>
<td></td>
</tr>
<tr>
<td>S. aureus</td>
<td>8</td>
</tr>
<tr>
<td>P. vulgaris</td>
<td>-</td>
</tr>
<tr>
<td>P. aeruginosa</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2: Comparison of antibacterial activity of standard antibiotics

<table>
<thead>
<tr>
<th>Name of the micro organism</th>
<th>Antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amikacin</td>
</tr>
<tr>
<td>E. coli</td>
<td>12</td>
</tr>
<tr>
<td>K. pneumonia</td>
<td>9</td>
</tr>
<tr>
<td>S. typhi</td>
<td>14</td>
</tr>
<tr>
<td>S. aureus</td>
<td>12</td>
</tr>
<tr>
<td>P. vulgaris</td>
<td>11</td>
</tr>
<tr>
<td>P. aeruginosa</td>
<td>15</td>
</tr>
</tbody>
</table>

According to Nagoba [14], the zones of inhibition of the antibiotics are compared with the zones of inhibition of test organisms and the results can also be interpreted based on the following criteria.

Sensitive

When zone diameter of test organism is greater than or equal to or not more than 4 mm, then the result can be interpreted as sensitive.

Medium sensitive

If the zone diameter is at least 12 mm but reduce in by more than 4 mm.

Resistant

If it shows no zone of inhibition of growth or if zone diameter is not >10 mm.

Among the five spices tested, aqueous extracts of Ajwain and cumin exhibited antibacterial activity against one organism (S. aureus).
Alcoholic extract of Ajwain exhibited antibacterial activity against four organisms (E. coli, K. pneumonia, P. vulgaris, P. aeruginosa, and S. typhi). The alcoholic mixed spice sample exhibited antibacterial activity against four of the test organisms (K. pneumonia, P. vulgaris, S. aureus, and E. coli). Comparatively the alcoholic extracts gave a better response than the aqueous extracts.

The results of the antibacterial activity assays are represented in Tables 1 and 2.

On comparing the antibacterial activity exhibited by the standard antibiotics, the study reveals that the selected Ajwain sample has more antibacterial property and the next being the cumin sample whereas the mixed spice sample was at the best in exhibiting the antibacterial activity at the concentration of 100 µL. The other samples of coriander, fennel, and fenugreek lacked antibacterial property.

The effectiveness of the antibacterial activity was recorded better for the mixed spice samples when compared to that of the individual spices. This clearly emphasizes that the combined effect of the spices exhibited better antibacterial activity and the kill rate of the bacterial strains is higher relatively.

REFERENCES