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ANTIBACTERIAL ACTIVITY OF EXTRACTS OF SOME SPICES ON GROWTH OF METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* STRAINS

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Abstract
Food poisoning is still a problem for consumers and food industry despite the use of various preservation methods. Moreover the increasing emergence of nosocomial isolates of staphylococcus aureus exhibiting resistance to methicillin. Traditionally people use herbs in treatment of diseases or as preservatives and it is well established that the extracts of spices have antimicrobial properties. This study is carried out to determine the antibacterial activity of the aqueous extract of cinnamon, cumin and coriander on growth of methicillin resistant Staphylococcus aureus (MRSA). Different concentrations of the aqueous extracts of cinnamon, cumin and coriander were prepared for detection of the minimum inhibitory concentration and minimum bactericidal concentration of the aqueous extracts on MRSA by using the micro-dilution method. It was indicated that the aqueous extract of cinnamon which was effective at the minimum concentration of 7.8125 mg ml^{-1} and MBC value of 15.625 mg ml^{-1} is the most potent followed by cumin at MIC value of 15.625 mg ml^{-1} and MBC value of 31.25 mg ml^{-1}, and coriander extract which is the least potent at MIC value of 31.25 mg $ml^{-1}$and MBC value of 62.5 mg ml^{-1}. It is concluded that the extract of cinnamon and cumin are rich source of antimicrobial compounds and can be added as natural food preservatives.

Keywords: cinnamon, cumin, coriander, MRSA, antimicrobial activity

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1. INTRODUCTION

The antimicrobial activities of plant extracts have formed the basis of many applications, including raw and processed food preservation, pharmaceuticals, alternative medicine and natural therapies (Akin *et al*., 2010). In many developing countries traditional medicine is one of the primary health care systems.

Plants have been a rich source of medicines because they produce wide array of bioactive molecules, most of which probably evolved as chemical defense against predation or infection. Herbs and spices are well known for their preservative and medicinal value as well as for boosting the flavor, color and aroma of the food. In the global food industry more priority is given to natural preservatives as there is increase occurrence of resistance in pathogenic strains against chemical food preservatives (Kumar et *al*., 2011).

The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for potential antimicrobial activity, and the plant extracts were found to have potential against microorganisms (Mandal et al., 2010).

Methicillin-resistance *Staphylococcus aureus* (MRSA) has been emerging world wide as one of the most important hospital and community acquired pathogens. It is responsible for a wide range of diseases, including endocarditis, osteomyelitis, toxic-shock syndrome, pneumonia, food poisoning and carbuncles. These infections can occur in wounds or skin, burns and other sites where tubes enter the body, as well as in the eyes, bones, heart or blood (Aliyu et al., 2008).

The structure of distribution of staphylococci in food indicates that meat and poultry or their products were vehicle in 75% of incidents. Seafood accounted for 7% and dairy foods for 8%.

Most contamination occured from hospital infection via wounds and mucos membranes, Methicillin –resistant *Staphylococcus aureus* is a major cause of them. Staphylococci

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resistance to antibiotics has resulted in the emergence of strains of *Staphylococcus* called MDR (Multidrug Resistance). Their presence is caused by inhibition of NorA efflux mechanisms. However, there are many substances of plant origin as phytoncides, which express diverse biostatic activity in relation to staphylococci. Phytochemicals and phytoncides is a large group of compounds found in different plant species.

Numerous plants may contain one or many of these phytochemicals placed in seeds, fruit, leaves, stems, flowers, tubers.

Phytoncides show diverse chemical definition - compounds that belong to them – can be classified as: organic acids, phenols, alkaloids, terpenes, polyketones, polyenes, sulfur products, flavonoids (Steinka and Kukulowicz, 2011).

This study aimed to examine the antimicrobial activity of aqueous extracts from cinnamon, cumin and coriander on MRSA.

2. MATERIAL AND METHODS

Preparation of extract and concentration

Fifty grams of grinded spices (Cinnamon bark, cumin seeds and coriander seeds) which collected from retail markets in Assiut city were mixed with 250 ml sterile distilled water for 24 hours at room temperature, then filtered by muslin cloth, then by Whatmann No.1filter paper, centrifugation, evaporation till leave pasty material, weighted and stored in an airtight container at 4 C until use (Kumar et al. 2011).

Preparation of the bacterial strain

The MRSA strains used in this study were previously isolated from RTE meat products and tested for methicillin resistance.

Five isolates were cultured on Nutrient Agar plates and were incubated for 24 h at 37°C. Few colonies from these cultures were inoculated and incubated into Mueller-Hinton Broth for 24 h at 37°C. Dilute till reach the desired inoculums 1×10^6 CFU $ml^{-1.}$ (Hêro, 2012).

Determination of minimum inhibitory concentration MIC and minimum bactericidal concentration (MBC)

By using broth microdilution method, the wells were filled with 100 µl of sterile plant extracts were added to the wells by serial two fold dilution from the suspension of plant extract stock solution. Each well was inoculated with 100 µl standard bacterial suspension 1 x 10^6 CFU/ml. Concentrations of 250, 125, 62.5, 31.25, 15.625, 7.8125, 3.9, 1.95, 0.975 and 0.4875 mg/ml were prepared and the last two wells used for the positive and negative controls. The Micro titer plates were covered, placed in plastic bags and incubated at 37°C for 24 hrs (Wiegand et al., 2008).

MIC known as the lowest concentration of the extract showing no visible growth in the well, while MBC known as the minimum concentration of the extract showing no growth after inoculation on the agar and incubation.

3. RESULTS AND DISCUSSION

Table (1): MIC and MBC of the examined spices extracts against MRSA by micro-dilution method

Plant extract	MIC (mg ml^{-1})	MBC(mg ml^{-1})
Cinnamon	**7.8125**	**15.625**
Cumin	**15.625**	**31.25**
Coriander	**31.25**	**62.5**

Food-borne illness is an important public health problem as it not only affects human health but also has a significant effect on world economic and trade issues. *Staphylococcus aureus* is one of the common contaminant of food spoilage as well as food borne diseases. Various herbal plants were widely utilized as natural antimicrobials and antioxidants. The demand of these herbal products is increasing because of their antimicrobial activity against many human as well as animal pathogens (Kumar et al. 2011).

Spices extracts were checked against MRSA. The MIC values of Cinnamon, cumin and coriander extracts were 7.8125, 15.625 and

31.25 mg ml^{-1}, while the MBC values were 15.625, 31.25 and 62.5 mg ml^{-1}, respectively (Table 1). The study indicated that aqueous cinnamon extract is the most potent followed by the aqueous extract of cumin, while aqueous extract coriander has the least activity against MRSA. Similar results obtained by Mandal et al., (2011) found that cinnamon showed the strongest in vitro antibacterial activity this attributed to cinnamaldehyde (50.5%), which has been proven to be active against many pathogenic gram-positive and gram-negative bacteria, followed by cumin against MRSA and Keskin and Toroglu (2011) who detected that cinnamon then cumin extracts have inhibitory effect against *Staphylococcus aureus*, but coriander extract showed the least antibacterial activity. Abdul Rahman et al., (2010) found *S. aureus* was to be susceptible to cumin, cinnamon, as well as Chao et al. (2008) who found that cinnamon and cumin extracts are active inhibitors against MRSA as a source of phytochemicals that are active inhibitors of these bacteria growth. In contrary, some workers have found that coriander has strong antibacterial activity against *S. aureus* (Al-Jedah *et al*., 2000), which may be due to the different bio-reactive compounds formed due to different preparation methods.

4. CONCLUSIONS

It is concluded that the aqueous extracts of cinnamon and cumin have good antibacterial effect against MRSA, and it is recommended to add these spices to meat and meat products as natural preservatives, but coriander has the least effect on MRSA growth.

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