

Antibacterial activity of *Piper nigrum*, *Coriandrum sativum*, *Trigonella foenum-graecum* and *Ferula narthex*

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Abstract

The antibacterial activity of water and acetone extracts of black pepper, coriander, fenugreek and asafoetida was tested against six clinically important bacteria namely *Escherichia coli*, *Klebsiella* sp., *Staphylococcus aureus*, *Bacillus* sp., *Salmonella typhi* and *Salmonella paratyphi A*, by disc diffusion method, in the lawn culture of the organisms in nutrient agar. *E. coli* was found to be susceptible to all the extracts, except the water extract of black pepper. The growth of *S. typhi* and *S. paratyphi A* was also inhibited by various extracts. Thus our results support the evidence that spices, not only provide flavour to food, but also check the growth of some of the undesirable bacteria.

Key words: antibacterial properties, asafoetida, black pepper, coriander, fenugreek

Natural spices are used in a variety of food products. Many of them are rich in essential oils, flavonoids, minerals, vitamins etc. (Pruthi 1992; Pradeep *et al.* 1993). Though organic acids, chlorine dioxide, trisodium phosphate, steam, hot water etc. are used extensively to reduce bacterial contamination of food, use of novel antimicrobial agents to reduce the growth of contaminants and food borne pathogens like *Escherichia coli* and *Salmonella typhi* are gaining importance (Cutter 2000). Spices like black pepper, coriander, fenugreek, asafoetida, mustard, chilli etc., which form an integral ingredient of the diet of Keralites, are reported to be rich in antimicrobial secondary metabolites also (Zaika 1988; Pruthi 1992; De *et al.* 1999). Reports on the effect of these spices on the growth of food borne and other pathogenic bacteria are meagre. Hence the effect of some of the commonly used spices on some pathogenic bacteria, especially food

borne, was studied and the results are reported.

The spices tested for antibacterial activity were collected from local markets. The seeds of fenugreek (*Trigonella foenum-graecum* L.) and coriander (*Coriandrum sativum* L.), berries of black pepper (*Piper nigrum* L.) and asafoetida (*Ferula narthex*) (gum resin of root) were used for the study. For the preparation of water extract, 500 mg of the material was homogenized and mixed with 5.0 ml of sterile distilled water. The solutions were kept overnight and centrifuged. For the preparation of acetone extract, 500 mg of the material was dried at 55°C, ground to fine powder and mixed with 2.5 ml of acetone. The solutions were allowed to sediment overnight at room temperature. The supernatant was dried dissolved in appropriate solvents and used for the study of antibacterial activity. Six clinically important bacteria used in the present study included both Gram +ve and Gram-ve

organisms. Gram +ve organisms were *Staphylococcus aureus* and *Bacillus* sp. Gram -ve organisms included *Escherichia coli*, *Klebsiella* sp., *Salmonella typhi* and *S. paratyphi* A. The organisms were collected from the Department of Microbiology, Little Flower Hospital, Angamaly, Kerala. They were maintained on nutrient agar slants, at 4°C and sub cultured periodically.

The antibacterial activity was studied by the disc diffusion method (NCCLS 1997). Lawn culture of the organisms were prepared on nutrient agar plates using overnight peptone water cultures containing 10⁶ cfu ml⁻¹. Filter paper discs (5 mm dia.) impregnated with solutions (each disc containing 500 µg of plant components) were placed on the air-dried surface of the media, inoculated with respective microorganisms. Discs containing the pure solvents were used as control. After overnight incubation at 37°C, the zones of inhibition around the discs were measured. There were three replications.

The results of our studies are given in Table 1. The preparations of the plant materials were active against most of the tested organisms, except the water extract of black pepper, which was active against *Bacillus* sp. only. The control discs produced no discernible zone of inhibition. *E. coli* was found to be susceptible to all the extracts, except the water extract of black pepper. The acetone extract of asafoetida and coriander gave a zone of inhibition of 10.5 mm.

The zones of inhibition of other extracts were between 8 and 10 mm.

The extracts of all the spices showed activity against *S. aureus*. The acetone extract of asafoetida gave a zone of inhibition of 11 mm, which was greater than those of other extracts. The fact that *S. aureus* is susceptible to various extracts appears to be significant because *S. aureus* which develops multiple drug resistance, is one of the organisms that causes nosocomial infections. However, further investigations are to be carried out to confirm whether these spices are active against methicillin resistant strains of *S. aureus*. The water extracts of asafoetida and fenugreek showed significant activity against *S. typhi* and *S. paratyphi* A, the common food borne intestinal pathogens, causing enteric fever. The acetone extract of coriander also was active against *S. typhi*.

Plant derived antimicrobials have been recognized by several workers as a means to check the growth of undesirable bacteria (Brantner *et al.* 1996; Vijaya & Ananthan 1996; Cutter 2000; Puupponen-Pimia *et al.* 2001). Puupponen-Pimia *et al.* (2001) have reported the antibacterial activity of several berries against *S. enterica*. The essential oil of several plants including coriander shows activity against several bacteria such as *S. aureus* and *Klebsiella pneumoniae* (Baratta *et al.* 1998; Thoppil 2000). Lafont *et al.* (1986) reported that chloroform extracts of garlic, cinnamon, thyme, clove, saffron, coriander, pep-

Table 1. Effect of extracts of different spices on different bacteria

Organism	Zone of inhibition (mm)*							
	Black pepper		Fenugreek		Coriander		Asafoetida	
	WE	AE	WE	AE	WE	AE	WE	AE
<i>Staphylococcus aureus</i>	0.0	9.0	0.0	8.0	8.0	8.0	0.0	11.0
<i>Escherichia coli</i>	0.0	8.0	9.0	10.0	9.5	10.5	10.0	10.5
<i>Klebsiella</i> sp.	0.0	0.0	10.0	0.0	8.0	10.0	0.0	8.0
<i>Bacillus</i> sp.	9.5	0.0	0.0	0.0	0.0	0.0	12.5	0.0
<i>Salmonella typhi</i>	0.0	0.0	9.0	0.0	0.0	8.0	8.5	0.0
<i>S. paratyphi</i> A.	0.0	0.0	10.0	8.0	0.0	0.0	8.0	0.0

* Values include diameter of the filter paper disc (5.0 mm), Means of three replicates. WE - Water extract and AE - Acetone extract

per and nutmeg showed bacteriostatic activity against *S. aureus* and *Vibrio* sp. The antibacterial and antifungal activities of garlic extracts have also been reported (Graham & Graham 1987; Ghnannoum 1988; Sato *et al.* 1990; Wagner *et al.* 1994). The antimicrobial activity of clove, cinnamon, mustard, ajowan and cumin also have been reported earlier (Meena 1992).

Thus the above mentioned spices not only provide flavour to food, but may also play a role in checking the growth of undesirable bacteria in the food. Further studies on the bioactive compounds present in the extracts of these spices are in progress.

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