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A comparative study on the antibiotic property of commonly used culinary spices

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Abstract
There has been an increasing interest in the development of neutracueticals to combat the drug resistant pathogens. Although spices have been well accepted as traditional medicine, antimicrobial effect and isolation of its active constituents are still in infancy. Hence the antimicrobial activity of the aqueous extracts of commonly used spices against *Escherichia coli* were determined and compared with antibiotic amikacin. The pathogen *Escherichia coli*, a versatile one, causes a multitude of infection among humans. Zone of inhibition was determined by disc diffusion method. The spices exhibited antibiotic efficacy in various magnitudes. Among spices, *Tamarindus indica* and *Cinnmomum zeylanicum* were extremely sensitive against *Escherichia coli* followed by *Curcuma longa*, *Zingiber officinale* and *Allium sativum* which were very sensitive. Syzium aromaticum and Capsicum Chinese also exhibited antibiotic activity.

Keywords: spices, antimicrobial activity, zone of inhibition, Escherichia coli

1. Introduction
Antibiotic resistance poses an ever-increasing threat to life and health. Despite plentiful information on how to reduce this threat, we seem to be losing the battle. Plants with their complex medley of bioactive compounds are likely to harbour at least part of the answer to our ever-increasing problem of multidrug resistant microbes. [1]

Spices have been used since antique time to impart flavour, colour, taste and aroma in food preparation and they also hold a robust place as traditional medicine in both eastern and western medical systems. In the contemporary world, spices as traditional medicines are gaining more significance as they are easily available, affordable, and acceptable with little or no side effects.

Plants with ethno pharmaceutical importance were being examined for their efficient antibiotic properties. Plant extracts such as aniseeds, basil, cinnamon, chilli, clove, citronella, ginger garlic, mint, nutmeg, turmeric, tamarind have been consumed by folks in cuisines all over the world in their day today life. These spices contain bioactive components that possess excellent antimicrobial, antifungal, anti-inflammatory properties and so on. If these foods are taken regularly in tolerable amounts, the prevalence of many disorders can be ameliorated.

Eschericia coli is an adaptable pathogen and sometimes lethal. Several different *E. coli* strains cause varied intestinal and urinary tract infections by means of virulence factors that targets various organs.

Hence this study was demonstrated to determine the antimicrobial activity of selected spices like cinnamon, red chilli, clove, ginger, garlic, turmeric and tamarind against Escherichia coli and compare it with a standard antibiotic

2. Materials and methods
Disc diffusion method
The aqueous extracts of the spices cinnamon, chilli, clove, garlic, ginger, turmeric and tamarind were prepared in the laboratory. Stains of Eschericia coli were purchased from Green med labs, Chennai, Tamil Nadu, India. The anti-biotic properties of the spices under investigation were determined by the Disc Diffusion method. The volume of 0.1ml of the experimental microorganisms grown in liquid growth media at 37° C was inoculated on Muller-Hinton growth media and then spread on the entire surface of the Petri dish using a sterile swab. Then sterile paper discs (Whatman 1.6 mm) having absorbed specific amounts of the above spice extracts (100µg, 500µg and 1000µg) were gently pressed in the Muller-Hinton agar. These plates were then incubated at 35°C for 24 hours. After the incubation period, the inhibition zones around the paper discs were measured in millimeters and categorized as per the procedure of Ponce *et al.* (2003) [5] and Moreira *et al.* (2005) denoted in Table 1.

Table 1

Sensitivity	Diameter in mm
Non sensitive (-)	Smaller than 8 mm
Sensitive (+)	Between 9 – 14 mm
Very sensitive	Between 15 – 19 mm
Extremely sensitive	Larger than 20 mm

3. Results and discussion
The zone of inhibition demonstrated by the spices are represented in Table 2. The results revealed the antimicrobial activity of selected spices in varying magnitudes. Among the spices tamarind demonstrated the maximum inhibitory concentration followed by cinnamon. Glycosides serve as defence mechanisms against predation by microbes which explains the antimicrobial activity of tamarind against Ecoli. [2]. Findings of this study were in agreement with [3] who reported that extract of cinnamon showed highest antibacterial activity against Ecoli.

Table 2

Common Name	Botanical name	Anti-microbial Constituent
Cinnamon	Cinnamomum Zeylanicum	Cinnamaldehyde
Clove	Syzygium aromaticum.	Eugenol, carvacrol
Chilli	Capsicum Chinese	Capsaicin
Ginger	Zingiber officinale	Myricetin
Garlic	Allium sativum	Allicin
Turmeric	Curcuma longa	Curcumin
Tamarind	Tamarindus indica linn	Aglycon (glycoside)

Ginger and garlic had a very slight zone of inhibition whereas clove and chilli exhibited meagre zones which was in accordance with [4] that essential oil of clove concentration exerted bactericidal action against Escherichia coli.

Thus the Escherichia coli was extremely sensitive to tamarind and cinnamon, very sensitive to turmeric, sensitive to ginger, garlic, clove, chilli in concentration of 1000 µg. The control antibiotic amikacin demonstrated a zone of inhibition of 16 mm in a concentration of 30 µg which was less than tamarind and cinnamon.

The emergence of multidrug resistance pathogen is becoming a global problem. Prevention seems to be the need to tackle this problem at this juncture. The attempt to discover new natural therapeutics, has induced scientists all over the world to seek solution from the field of bioactive components from spices

Table 3: Source: Abreu *et al.* 2012, De 2009

Spice	Zone of Inhibition in mm		
	100µg	500µg	1000µg
Cinnamon	14	20	20
Clove	NA	8	14
Chilli	NA	8	12
Ginger	NA	8	10
Garlic	NA	8	10
Tamarind	14	18	22
Turmeric	8	12	18
Amikacin 30 µg	16	16	16

4. Conclusion

Thus this study has evaluated the antimicrobial activity of some well-known culinary spices like cinnamon, clove chilli, ginger, garlic, turmeric, tamarind with emphasis on their application as effective antimicrobial agents. Thus the use of spices at appropriate levels can help us to battle against deadly infections which pose a great challenge for the community. It is essential to carry out more scientific experiments on these spices to find a remedy for multidrug resistant pathogens.

5. References

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