5th International Electronic Conference on Medicinal Chemistry

1-30 November 2019

chaired by Dr. Jean Jacques Vanden Eynde

sponsored by pharmaceuticals

IN VITRO ANTIMICROBIAL EFFECT OF CURCUMIN

Tomasz M. Karpiński[1]*, Artur Adamczak[2], and Marcin Ożarowski[3]

[1] Department of Medical Microbiology, Poznań University of Medical Sciences, Wieniawskiego 3, 61-712 Poznań, Poland

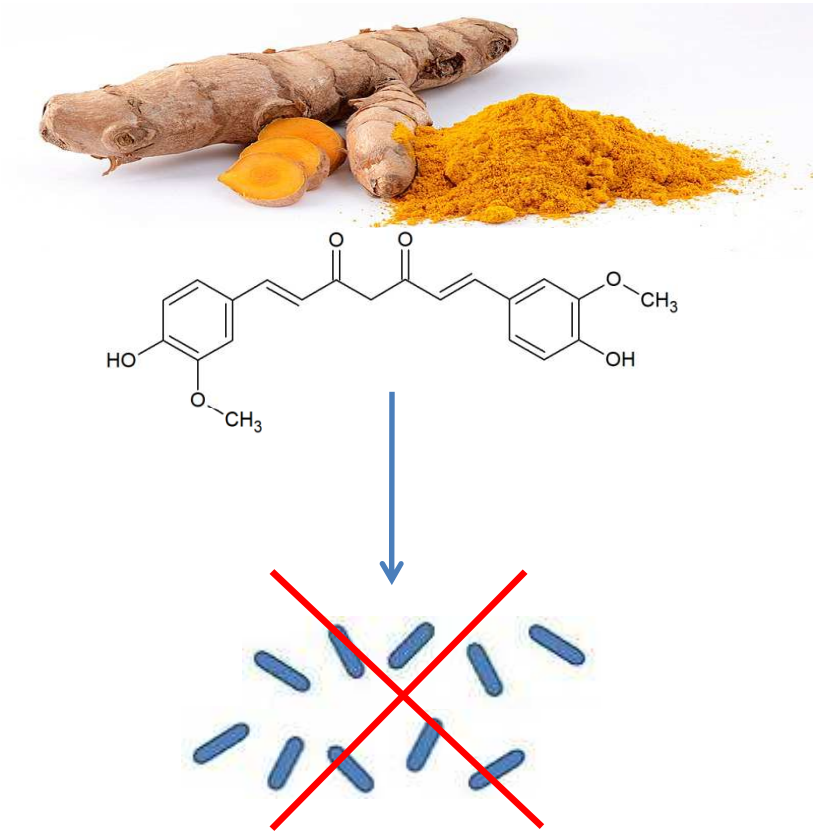
[2] Department of Botany, Breeding and Agricultural Technology of Medicinal Plants, Institute of Natural Fibres and Medicinal Plants, Kolejowa 2, 62-064 Plewiska, Poland

[3] Department of Biotechnology, Institute of Natural Fibres and Medicinal Plants, Wojska Polskiego 71b, 60-630 Poznań, Poland

* Corresponding author: tkarpin@ump.edu.pl

In vitro antimicrobial effect of curcumin

Graphical Abstract



https://en.wikipedia.org/wiki/File:Curcuma_longa_roots.jpg

Abstract:
Curcumin is a major phenolic constituent of *Curcuma longa* L. The purpose of the present work was comparative analysis of the antimicrobial activity of curcumin using CLSI recommendations. In the study, there were tested six Gram(+) bacteria (*Enterococcus faecalis*, *Staphylococcus aureus*, MRSA, *S. epidermidis*, *Streptococcus agalactiae*, *S. pyogenes*), five Gram(-) (*Acinetobacter lwoffii*, *Escherichia coli*, *Klebsiella oxytoca*, *Proteus mirabilis*, *Pseudomonas aeruginosa*) and fungus *Candida albicans*. The minimal inhibitory concentrations (MICs) of curcumin were determined by the micro-dilution method. Curcumin was dissolved in 40% water solution of DMSO. Curcumin did not inhibit the growth of *C. albicans*, MRSA, *S. agalactiae*, and *P. mirabilis* (MICs >1000 µg/mL), while it demonstrated very strong effect on strains of *S. epidermidis* (MICs 15.6-31.25 µg/mL) and *S. pyogenes* (62.5-125 µg/mL). Curcumin sensitivity was also observed for *A. lwoffii* (125-250 µg/mL), *P. aeruginosa* (250-500 µg/mL) as well as *E. coli* and *K. oxytoca* (500-1000 µg/mL). Among *S. aureus* and *E. faecalis* strains, we found both resistant (MICs >1000 µg/mL) and sensitive (500 µg/mL) bacteria. Summarizing our study, curcumin belongs to the potent natural antibacterial agents of plant origin, but its activity varies greatly depending on the species and even the bacterial strain.
Keywords: *Curcuma longa*; Antibacterial; Minimal inhibitory concentration (MIC)

Introduction

Curcumin is a major phenolic constituent of turmeric (*Curcuma longa* L.) rhizomes. This substance has been described as an anti-inflammatory, antibacterial, and antifungal agent.

Unfortunately, the literature data concerning its antimicrobial activity provide very diverse results. Moreover, some of them are doubtful, especially when curcumin has been dissolved in chemical compounds inhibiting bacterial growth: ethanol or methanol.

Therefore, the purpose of the present work was to carry out comparative analyses of the antimicrobial activity of curcumin using recommendations prepared by the Clinical and Laboratory Standards Institute (CLSI).

Methods

In the study, there were tested six Gram-positive (*Enterococcus faecalis*, *Staphylococcus aureus*, methicillin-resistant *S. aureus* /MRSA/, *S. epidermidis*, *Streptococcus agalactiae*, *S. pyogenes*) and five Gram-negative bacteria (*Acinetobacter lwoffii*, *Escherichia coli*, *Klebsiella oxytoca*, *Proteus mirabilis*, *Pseudomonas aeruginosa*) as well as pathogenic fungus *Candida albicans*. For each species, four clinical strains were used.

The minimal inhibitory concentrations (MICs) of curcumin were determined by the micro-dilution method described in details in our previous publications [1,2].

Curcumin was dissolved in 40% water solution of dimethyl sulfoxide (DMSO), which in this concentration has not antimicrobial effect.

[1] Karpiński T.M. Efficacy of octenidine against *Pseudomonas aeruginosa* strains. Eur J Biol Res. 2019, 9, 135-140.
[2] Karpiński T.M., Adamczak A. Fucoxanthin - an antibacterial carotenoid. Antioxidants 2019; 8(8): 239.

Results

Microorganism	MIC (µg/mL)
Staphylococcus aureus	>1000 - 500
MRSA (methicillin-resistant *Staphylococcus aureus*)	>1000
Staphylococcus epidermidis	**31,25 - 15,6**
Streptococcus pyogenes	**125 - 62,5**
Streptococcus agalactiae	>1000
Enterococcus faecalis	>1000 - 500
Acinetobacter lwoffii	250 - 125
Pseudomonas aeruginosa	500 - 250
Klebsiella oxytoca	1000 - 500
Escherichia coli	>1000 - 500
Proteus mirabilis	>1000
Candida albicans	>1000

Results

In vitro analyses have shown a large diverse of curcumin activity.

This plant metabolite did not inhibit the growth of *C. albicans*, MRSA, *S. agalactiae*, and *P. mirabilis* (MICs >1000 µg/mL).

It demonstrated very strong effect on strains of *S. epidermidis* (MICs: 15.6-31.25 µg/mL) and *S. pyogenes* (62.5-125 µg/mL). Curcumin sensitivity was also observed for *A. lwoffii* (125-250 µg/mL), *P. aeruginosa* (250-500 µg/mL) as well as *E. coli* and *K. oxytoca* (500-1000 µg/mL).

Among *S. aureus* and *E. faecalis* strains, we found both resistant (MICs >1000 µg/mL) and sensitive (500 µg/mL) bacteria.

Conclusions

Summarizing our study, curcumin belongs to the potent natural antibacterial agents of plant origin, but its activity varies greatly depending on the species and even the bacterial strain.

The above-mentioned compound was very strong against *S. epidermidis* and *S. pyogenes*, and at the same time it had weak or no activity on other Gram-positive bacteria. In the case of Gram-negative ones, curcumin exhibited moderate, weak or none antibacterial effect.