

Mode of action of cinnamon bark (*Cinnamomum verum*) essential oil and the combinatory bactericidal activity with meropenem against KPC-producing *Klebsiella pneumoniae*

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Abstract

Antimicrobial resistance is an ongoing challenge in the clinical setting at present. To address this issue, combinatorial therapies have been applied in the clinical setting to tackle multi-drug resistant bacterial infections and these have frequently proven to be effective. In addition to the wider acceptance amongst the general public for nature-based products, the mining of novel antimicrobials is moving towards the direction of greener plant-based compounds from synthetic chemical compounds such as essential oils. Thus, this study was undertaken to look at the combinatory effects of cinnamon bark essential oil (CBO) and meropenem against KPC-producing *K. pneumoniae*. We found that CBO had a relatively low MIC of 0.16% (v/v) when used against KPC-producing *K. pneumoniae*. When used in combination, the MIC is further reduced to 0.08% (v/v). Furthermore, we also found that mode of action of CBO involved the disruption of the bacterial membrane, as determined in the zeta potential measurement, outer membrane permeability assay and scanning electron microscopy. Comparative proteomic via label free LC-MS/MS had also been performed on the non-treated and CBO-treated KPC-KP cells which further validated the disruption in the bacterial membrane as well as in the membrane and cell wall- repairing mechanism. Hence, results obtained from our studies strongly suggests that CBO may potentially play a promising role with regards to the mining of novel antimicrobial compounds, which inevitably may help eradicate antimicrobial resistance infections in the clinical setting.

Keywords: Cinnamon bark essential oil; combinatorial therapy; comparative proteomic; label free LC-MS/MS; membrane disruption.

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