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Cinnamomum verum (Syn. *C. zeylanicum*) LEAF ESSENTIAL OIL AS A *Candida* BIOFILM CONTROL STRATEGY

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Abstract
The oils extracted from cinnamon leaves has been used as an antimicrobial agent for generations. However, the antibiofilm activity of cinnamon leaf oil is not well studied. This study evaluates the effect of *C. verum* leaf oil on biofilm formation and mature preformed biofilms of *C. albicans* and *C. tropicalis*. Effect of essential oil (EO) on adhesion of *Candida* was evaluated by allowing cells to adhere to polystyrene surface for 2 h followed by cellular quantification using XTT. Inhibitory effect of cinnamon oil on forming biofilms in the presence of oil was evaluated using XTT viability. Visualization of biofilm aggregates under chemical stress of EO was done using Scanning Electron Microscope (SEM) and the biofilm progression was analyzed using Time lapses microscope. Effect of EO on preformed biofilms was determined and visualized using XTT assay and SEM respectively. Post-exposure cellular alterations were visualized using Transmission Electron Microscopy (TEM). *In- vivo* toxicity of oil was determined using *Galleria mellonella* larvae. Positive control: Chlorhexidine digluconate. 1.0 and > 2.0 mg mL^{-1} reduced initial adhesion of *C. albicans* and *C. tropicalis* respectively by 50%. Minimum Biofilm Inhibitory Concentration ($MBIC_{50}$) of forming biofilms were $\leq$ 0.35 mg mL^{-1} for both strains. Minimum toxic concentration which prevent biofilm development was 1.0 mg mL^{-1}. $MBIC_{50}$ for preformed biofilms were $\leq$0.2 mg mL^{-1} for test organisms. SEM indicated cellular shrinkages, cell wall damages, and decreased hyphae formation of *Candida*. TEM showed cell wall damages, intracellular granulation and vacuolization. No toxicity was observed with *in-vivo* experiment. *C. verum* EO causes reduced adhesion, retardation of *Candida* biofilm development and destruction of established biofilms of *Candida* spp without exhibiting any lethal effect on the *in-vivo* model.

***Keywords*:** *Cinnamomum verum*, Essential Oil, *Candida spp.*, Biofilms, *In-vivo* toxicity.