



## Hormetic effect caused by essential oil of *Cymbopogon citratus* on *Staphylococcus aureus* biofilm

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Hormesis has been classified as a biphasic dose-response phenomenon, characterized by high-dose inhibition and low-dose stimulation. Many compounds are capable of causing the phenomenon, including physical and chemical compounds. The hormesis occurrence in pathogenic strains can be a serious problem, particularly in the treatment of microbial diseases. Calabrese (1) recognized that low doses of antiviral, antibacterial and antitumor drug can improve the growth of these potentially harmful agents (microorganisms and cells) hurting the treatment of patient. During our study about the use of essential oils to control *Staphylococcus aureus* biofilm we observed, unexpectedly, the occurrence of hormesis caused by *Cymbopogon citratus* oil. We studied eleven clinical isolates of bovine mastitis, reported by Castelani *et al.* (2). The oil concentration was assessed in the range of 1.0 to 0.015 mg/mL and the minimum inhibitory concentration (MIC) was calculated using microdilution method (CLSI, 2005). The quantification of the biofilm was determined by Hess *et al.* (3), Beeken *et al.* (4), Li *et al.* (6) and Djordjevic *et al.* (5) methodologies. The results showed that the essential oil of *C. citratus* inhibited biofilm formation at various concentrations tested (0.06 – 0.5mg/mL). However, the sub-MIC concentrations increase biofilm formation in more than 50% relative to control. We believe this is the first time that essential oils are associated with hormesis phenomenon in *S. aureus* biofilm. This observation is very important and should incite the attention of researchers to the modulatory effects of essential oils in sub-MIC concentrations.

1. Calabrese, E. Environmental Toxicology and Chemistry, 2008, **27**, 1451-1474.
2. Castelani, L. et al. Int. J. Mol. Sci., 2013, **14**, 4326-4333.
3. Hess, D.J.; Henry-Stanley, M.J.; Wells, C.L. J. Surgical Res., 2011, **170**, 302-308.
4. Beeken, K.E.; Blevins, J.S.; Smeltzer, M.S. Infection and Immunity, 2003, 4206-4211.
5. Djordjevic, D.; Wiedmann, M.; Mclandsborough, L.A. Appl. Environ. Microbiol., 2002, **68**, 2950-2958.
6. Li, X.; Yan, Z.; Xu, J. J. Microbiology. 2003, **149**, 353-362.

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