Modulation of *Pseudomonas aeruginosa* Biofilm Architecture Using Natural Carotenoids: An Innovative Approach to Enhance Antibiotic Efficacy

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Antibiotic resistance is one of the most serious global health threats. Among the priority pathogens, *Pseudomonas aeruginosa* stands out due to its multidrug resistance and ability to form protective biofilms, severely limiting the efficacy of conventional treatments. This study investigates the potential of carotenoid-rich natural products to modulate the biofilm architecture of Pseudomonas aeruginosa PAO1 WT, with the goal of enhancing antibiotic penetration and efficacy. Based on their content, carotenoid fraction extracts of *Solanum lycopersicum* L., *Ipomoea batatas* L., and *Cucurbita moschata* Duchesne, were tested at various concentrations. Their effects on biofilm formation and virulence factors were assessed using scanning electron microscopy, digital microscopy, motility assays, and quantification of pyocyanin production, alongside chemical profiling by HPTLC and GC-MS. Preliminary results highlight promising anti-biofilm activity from several extracts, supporting a potential use of these natural compounds as adjuvants to antibiotic therapy.

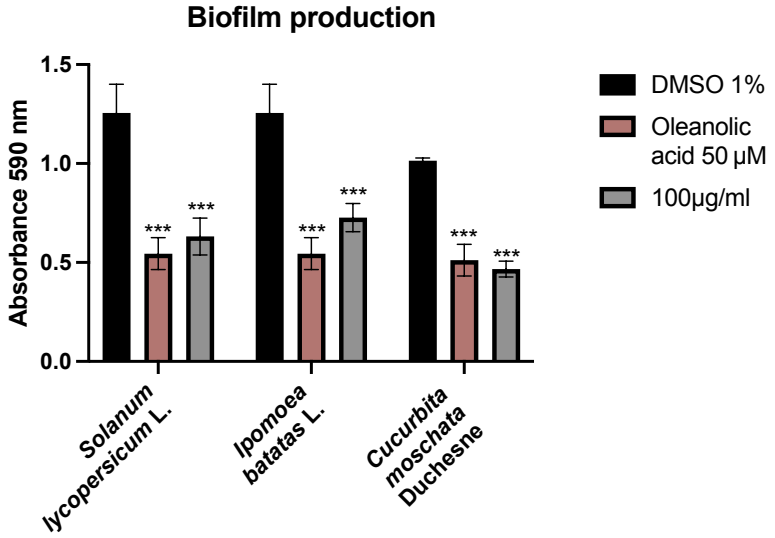

Fig 1. Effect of carotenoid fraction extracts of *Solanum lycopersicum* L., *Ipomoea batatas* L., and *Cucurbita moschata* Duchesne on biofilm formation by *P. aeruginosa*. The values are expressed as the arithmetic mean ± standard deviation (mean ± SD). Statistical analysis was performed using GraphPad Prism 8.0.2 software and subjected ANOVA one-way followed multiple comparison Tukey's test. Asterisks indicate samples that are significantly different from DMSO (P-values ≤ 0,001). All experiments were performed in triplicate with three independent assays.