"Impact of essential oils on the survival of *Artemia franciscana*"

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Essential oils (EOs) are natural mixtures of volatile organic compounds with numerous biological properties, including antimicrobial, antioxidant, and antiparasitic activities. However, their increasing release into the environment raises concerns about their potential toxic effects on aquatic organisms and, more broadly, about possible consequences for the biodiversity of marine ecosystems. In this study, the toxic and genotoxic effects of three essential oils, *Lavandula angustifolia* (lavender), *Melissa officinalis* (lemon balm), and limonene were evaluated, both individually and in combination, across different developmental stages of the marine crustacean *Artemia franciscana* (nauplii, metanauplii, juveniles, and adults), a widely used model organism in ecotoxicological studies due to its representative role in trophic networks.The experiments assessed the survival of organisms exposed to varying concentrations of each EO and their mixtures, measuring mortality rates after 48 hours. In addition, gene expression analysis was performed using Real-Time qPCR on seven stress-related genes (hsp26, hsp60, hsp70, COXI, COXIII, NADH, ZMP). The results revealed a toxic effect that varied depending on concentration and EO combinations, with some mixtures showing synergistic interactions that significantly increased lethality compared to individual compounds. Molecular analyses also revealed alterations in the expression of genes associated with oxidative stress and cellular damage, indicating a significant impact on the physiology of exposed organisms. Overall, these findings suggest that the environmental release of essential oils may represent a potential risk factor for aquatic biodiversity, affecting the survival and stability of key organism populations. The study therefore highlights the need for a thorough evaluation of their ecotoxicological impact, especially in light of their increasing industrial and cosmetic use. The use of *A. franciscana* as a model organism proved to be an effective approach for investigating the effects of these substances and for supporting future biodiversity monitoring and conservation strategies.