PHYSIOLOGY AND BIOCHEMISTRY

Investigating Potential Mechanisms of Clove Oil (Eugenol) in Model Systems

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Clove oil, used by humans as an essential oil, contains eugenol as an active ingredient. Eugenol acts as a topical anesthetic to remedy pain but the exact mechanisms are still not fully understood. We examined the resulting activity of eugenol on neuronal activity in sensory and motor neurons in crustacean models. Since crayfish, crab and shrimp hearts are neurogenic, we also hypothesized that the heart rate would decrease quickly in these animals. Surprisingly, this study found no change in heart rate despite administering eugenol into the hemolymph to reach 400ppm in crabs or crayfish but some shrimp preparations decreased. The activity of the primary proprioceptive neurons was reduced at 200ppm and ceased at 400ppm for both crayfish and crab preparations when saline containing eugenol was directly applied to exposed sensory organs. Flushing out eugenol resulted in recovery in the majority of the preparations. Administering eugenol to crayfish and crabs both systemically and through exposure in their aquatic environment resulted in the animals becoming lethargic. Direct injection into the hemolymph was quicker to decrease reflexes and sensory perception but heart rate was still maintained. Eugenol at a circulating level of 400ppm decreased electromyogram activity in the claw muscle of crabs. Excessive use of clove oil can result in overdose and cellular toxicity in humans. Overuse of topical eugenol may block proprioception in humans by the same mechanisms as in our model animals. Our next focus is to determine the mechanism of action by intracellular recordings from neurons.

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