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Investigating the effects of wood smoke exposure on developmental health, neurological development, and lifespan in Drosophila melanogaster

Abstract

Wood smoke, a major source of indoor air pollution in many low-income and rural households, contains several toxic pollutants such as particulate matter, volatile organic compounds, carbon monoxide, and polycyclic aromatic hydrocarbons. These pollutants are known to induce adverse reproductive and developmental outcomes. This study investigates the effects of chronic exposure to wood smoke on developmental capacity, morphology, neurological and transgenerational consequences in Drosophila melanogaster. Wild-type flies were exposed to wood smoke for 30 seconds, three times daily, using a custom-built chamber simulating household combustion. Developmental parameters such as egg-laying capacity and pupation rate were recorded. Morphometric parameters like weight, height, and gut pigmentation were assessed in both F1 and F2 generations. The results revealed a significant decline in pupal formation and body weight in the exposed group. Additionally, pupal arrest was observed, indicating developmental delay. The neurological observations showed consistent and significant decline in both distance climbed and number of responsive flies in the exposed group points toward neurotoxicity potentially affecting motor neurons or muscular function. Gut pigmentation and internal darkening in larvae pointed to potential ingestion of particulate residues. The findings suggest that even sublethal, chronic wood smoke exposure can impair reproductive health and cause transgenerational morphological changes in Drosophila, highlighting the potential risks biomass smoke poses to living systems.

Keywords: Wood smoke, reproductive toxicity, transgenerational effect, Neurotoxicity, Endocrine disrupting properties

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