

Effects of butter flavoring vapor exposure on cultured primary human tracheal/bronchial epithelial cell ion transport (660.11)

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Abstract

In the microwave popcorn industry, inhalation of butter flavoring may result in "popcorn workers' lung," a disease resembling bronchiolitis obliterans. Rats exposed for 6 h to vapor from butter flavorings diacetyl and 2,3-pentanedione demonstrate flavoring concentration-dependent damage of the upper airway epithelium. Because epithelial ion transport is essential for maintenance of transcellular electric potential, fluid transport and cellular volume, we investigated the effects of flavoring vapor exposure on ion transport in HTBE cells. We hypothesized that epithelial ion transport may be among the earliest targets associated with the onset of butter flavoring toxicity. Using a novel exposure system designed for cultured cells, HTBE cells were exposed for 6 h to diacetyl or 2,3-pentanedione vapors (25 ppm or >60 ppm). After exposure, cells were placed in an Ussing system to record short-circuit current (I_{sc}) at the 0 h or 18 h time-point. Flavoring (25 ppm) exposure reduced amiloride (apical; 3.5×10^{-5} M)-sensitive Na^+ transport as compared to controls. This reduction in Na^+ -dependent I_{sc} was not accompanied by changes in transepithelial resistance and recovered 18 h after exposure. Concentrations of diacetyl and 2,3-pentanedione above 60 ppm resulted in cell death. Our results demonstrate that flavorings reduce apical Na^+ conductance in airway epithelium.