

Volcanic ash from Puyehue-Cordón Caulle (2011) and Calbuco (2015) eruptions promote a distinct response on a human conjunctival cell line

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Ash produced during volcanic eruptions and particles remobilized from ashfall deposits can lead to adverse effects on human health, particularly on the respiratory system and the ocular surface. The aim of this work was to evaluate in vitro the effect of volcanic ash from Puyehue-Cordón Caulle (2011) and Calbuco (2015) eruptions on human conjunctival cells (IOBA-NHC). Volcanic ash was collected from the urban area of Villa La Angostura, Neuquén, Argentina. IOBA-NHC were exposed to 50, 100, 500 or 1000 $\mu\text{g}/\text{mL}$ of Puyehue or Calbuco ash for 24 h. Ash particles were suspended in growth media (DMEM-F12 with 10% FBS) and sonicated for 30 min. The following parameters were studied: pro-inflammatory cytokines levels (IL-6 and IL-8), MUC-1 expression, cell proliferation, apoptosis, reactive oxygen species (ROS) and nitrogen species (RNS) production and superoxide dismutase (SOD) and glutathione S-transferase (GST) activity. Regarding Puyehue ash exposure, IL-6 and IL-8 levels increased for 500 or 1000 $\mu\text{g}/\text{mL}$, proliferation decreased 20% ($p < 0.05$) and MUC-1 expression decreased 80% on cells exposed to 1000 $\mu\text{g}/\text{mL}$ ($p < 0.01$) when compared to control. Increased production of ROS (25% and 20%, $p < 0.01$) and RNS (183% and 143%, $p < 0.01$) along with a rise in SOD activity (29% and 39%, $p < 0.05$) were detected on cell cultures exposed to 50 or 1000 $\mu\text{g}/\text{mL}$ respectively. Only 1000 $\mu\text{g}/\text{mL}$ of Calbuco ash increased IL-8 levels and SOD activity (25%, $p < 0.05$). GST activity and apoptosis percentage showed no significant differences between exposed and control groups. These results suggest that volcanic ash from Puyehue-Cordón Caulle but not from Calbuco eruption induce on human conjunctival cells an inflammatory response mediated by IL-6 and IL-8 and an oxidative environment. These may lead to a reduction of MUC-1 expression which could pose a hazard to the conjunctival epithelial cells. However, cell integrity was not seriously compromised at least at the time studied.