Alteration in oxidative stress and F-actin assembly by incense particles

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Background

An increasing number of studies have linked apoptosis to alterations in cell cycle status post-exposure to ambient particulate matter (PM). Given the popularity of incense burning for religious ceremonies and to perfume indoor air, there is a paucity of incense smoke investigations, in terms of understanding cross-linking factors between F-actin assembly and oxidative capacity.

Objective

The objective of this study was to characterise the F-actin assembly occurring in human alveolar epithelial A549 cells following exposure to incense $PM_{2.5}$. Emphasis was placed on the roles played by the actin polymerisation. In order to determine the possible ROS mechanisms during F-actin assembly, the antioxidant levels in response to incense $PM_{2.5}$ treatment were maintained through supplementation with N-acetyl-L-cysteine (NAC).

Results and Conclusions

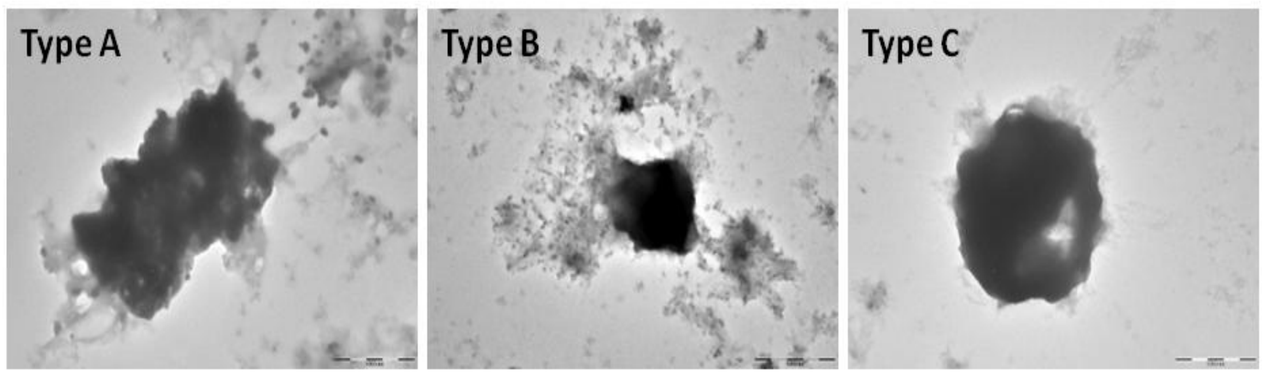

Figure 1. The collected incense $PM_{2.5}$ consisted of spherical singlets, chains and irregular-shaped aggregates.

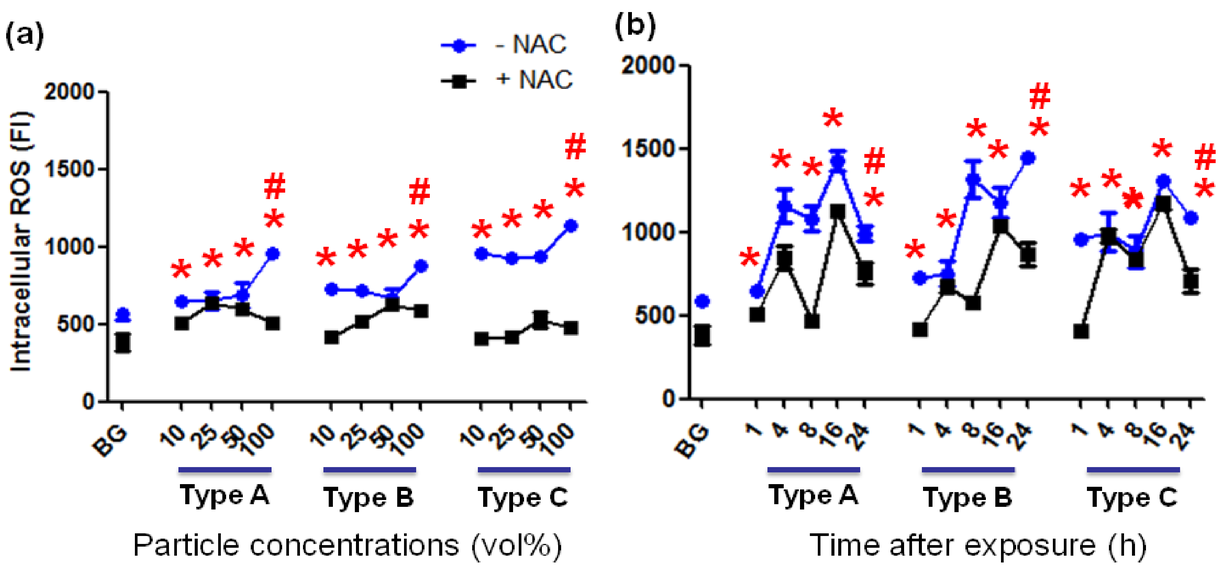

Figure 2. The cells significantly exhibited incense $PM_{2.5}$ induced intracellular reactive oxygen species (ROS) formation ($p<0.05$; compared to background (BG) levels in a dose-dependent manner, and a quadratic time response. The increased levels of ROS production caused by incense $PM_{2.5}$ were significantly reduced by the addition of NAC ($p<0.05$; a and b).

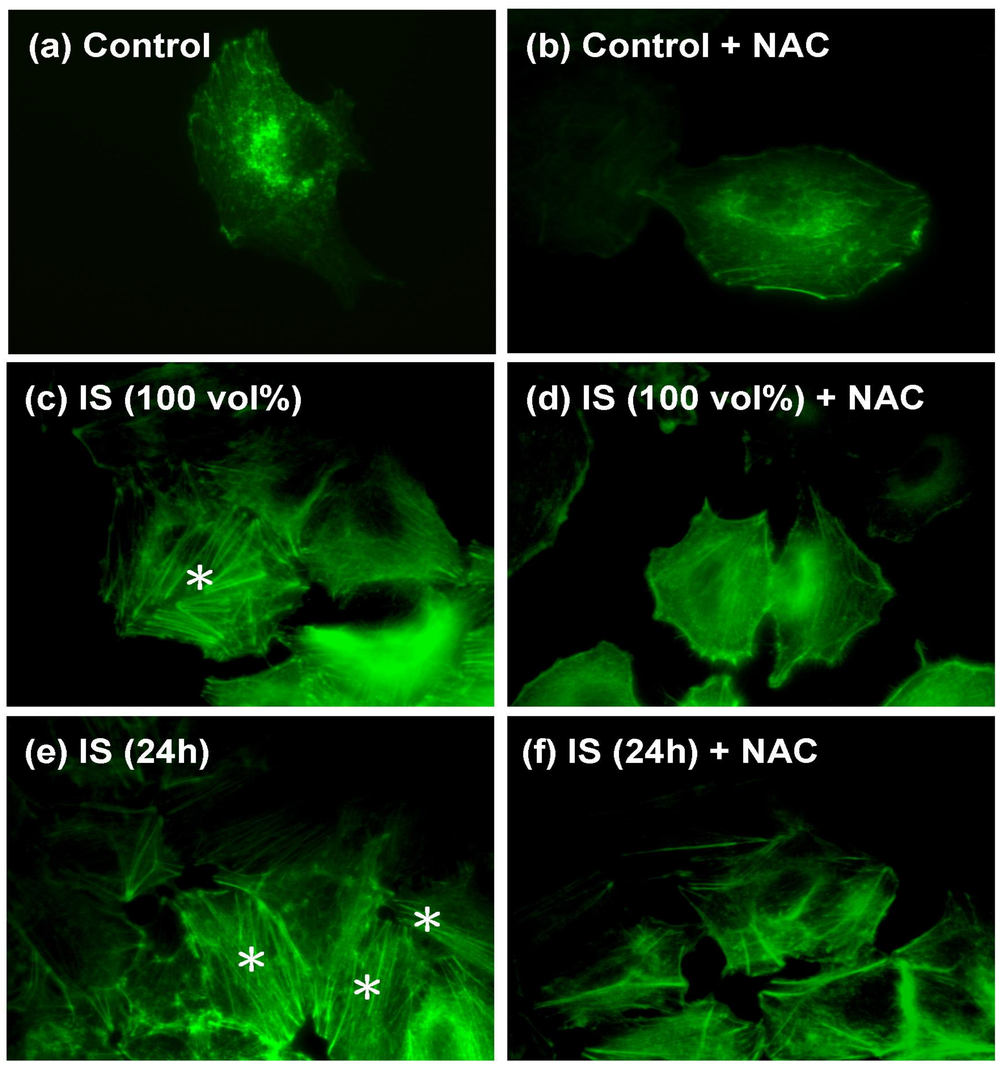

Figure 3. Significant cell shrinkage and the formation of actin stress fibers was observed with increasing incense $PM_{2.5}$ concentrations (3c) and incubation time (3e). Antioxidant pre-treatments significantly reduced the formation of stress fibers in cells under the same exposure conditions (3d, 3f). The elongated cytoskeleton became polygonal following incense $PM_{2.5}$ exposure (+NAC), especially after 24 hours incubation (3f).

This study demonstrates that incense $PM_{2.5}$ contained ROS induced cytoskeletal changes, suggesting that incense burning pose an environmental risk with regard to respiratory cell dysfunction. These results show that changes in the actin oxidation state activated an oxidative stress response. This response was also suppressed by the clinically important antioxidant NAC. Therefore ROS, generated via combustion derived processes such as incense burning, is a probable risk factor in the development of poor respiratory health.

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