Diabetics Are More Susceptible to Air Pollution: Effects of Urban Particulate Matter with High Glucose on Human Monocytes

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A number of epidemiological studies and animal experiments have shown that individuals with preexisting diseases, such as asthma, chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), and cardiovascular diseases are more susceptible to ambient particulate matter (PM)-related health problems. However, the underlying mechanisms are still unclear. Individuals with DM may be more susceptible to PM because they have preexisting inflammation, pro-oxidant states and endothelial dysfunction. In addition, hyperglycemia has been shown to activate macrophages/monocytes to secrete cytokines, which are involved in various hyperglycemia-induced cardiovascular diseases. Therefore, we hypothesized that PM and high glucose combined may cause enhanced effects on activation of monocytes and mitogen-activated protein kinases (MAPKs) through PM-induced oxidative stress, which may further activate matrix metalloproteinases (MMPs). Human monocytes U937 were used to test the effects of urban particulate matter (U-PM) and high glucose. Our results showed that exposure of monocytes to non-toxic doses of U-PM alone caused generation of reactive oxygen species (ROS), increased phosphorylation of Erk1/2 and p38, and up-regulation of MMP-9 mRNA expression and pro-MMP-2 and pro-MMP-9 activity. These effects were enhanced significantly when cells were exposed to U-PM in a high-glucose environment. These results may help us understand the health effects of PM on susceptible populations, such as those with DM. The results may also provide evidence to support policies that reduce particulate matter emissions.

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