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# Silica Nanoparticles Induced Oxidative Stress and Inflammation in MRC-5 Human Lung Fibroblasts

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**Abstract :** Silica nanoparticles (SiO2-NPs) are widely used in consumer products such as paints, plastics, insulation materials, tires, concrete production, as well as in gene delivery systems and imaging procedures. Environmental human exposure to them occurs during utilization of these products, in a time-dependent manner, the uptake being by topic and inhalation route especially. SiO2-NPs enter cells and induce membrane damage, oxidative stress and inflammatory reactions in a concentration-dependent manner. In this study, MRC-5 cells (human fetal lung fibroblasts) were exposed to amorphous SiO2-NPs at a dose of 62.5 µg/ml for 24, 48 and 72 hours. The size distribution of NPs was a lognormal function, in the range 3-14 nm. A time-dependent decrease of total reduced glutathione concentration by 36%, 50%, and 78% and an increase of NO level by 62%, 32%, respectively 24% compared to control were noticed. An up-regulation of NF-kB expression by 20%, 50% respectively 10% and of Nrf-2 by 139%, 58%, and 16% compared to control after 24, 48 and 72 hours was noticed also. The expression of IL-1β, IL-6, IL-8, and COX-2 was up-regulated in a time-dependent manner. Also, the expression of MMP-2 and MMP-9 were down-regulated after 48 and 72 hours, whereas their activities raised in a time-dependent manner. Exposure of cells to NPs up-regulated the expression of inducible NO synthase, as previously was shown, and probably this is the reason for the increased level of NO, that can react with the thiol groups of reduced glutathione molecules, diminishing its concentration Nrf2 is a transcription factor translocated in nucleus, under oxidative stress, where downstream gene expression activates in order to modulate the adaptive intracellular response against oxidative stress. The cross-talk between Nrf2 and NF-kB activities regulates the inflammatory processes. The activation of NF-kB could activate up-regulation of IL-1β, IL-6, and IL-8. The increase of COX-2 expression could be correlated with IL-1β one. Also, probably in response to the pro-inflammatory cytokines, MMP-2 and MMP-9 were induced and activated. In conclusion, the exposure of MRC-5 cells to SiO2-NPs generated inflammation in a time-dependent manner.

**Keywords :** inflammation, MRC-5 cells, oxidative stress, silica nanoparticles
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