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Effect of PM10 and Np-TIO$_2$ nanoparticles in monocytes

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Air pollution represents a global human health problem, especially in large cities such as Mexico, due to the high concentration of airborne particles (PM), in addition to other pollutants (such as TiO_2) that each day, exceed the permissible levels. This epidemiological evidence strongly suggests that air PM is associated with a higher morbidity and mortality rate, in respiratory, cardiovascular diseases and cancer development.

The development of these diseases are intensified by the inflammatory response of the organism in trying to eliminate the nano particles[3]. It has been suggested that inhaled particles may induce, systemic inflammatory response[1], through the release of IL-6, TNF, histamine and oxidative stress within the lungs. However, different investigations have shown that some nano particles (PM 10, 2.5 and 1.0) are not detected by cells specialized in eliminating them and therefore are not phagocyted by them in such a way that these nano particles evade this system of organism defense[3]. The worrying thing is that these nano particles, thus easily access the blood circulation, causing problems in other sites or distant organs. For what we believe is of interest, to study the effect caused by PM10 and nanoparticles of titanium dioxide (NP-TiO2) in monocytes, which should be the first line of defense of the organism.

Our results of transmission electron microscopy showed that in the monocytes exposed to NP-TiO_2, these endocitated the nano particles in phagosomes, have modifications in nucleus and organelles (Fig1), contrary to what does not happen with PM10. We found in transmission electron microscopy that PM10 is observed adhered to the plasma membrane (Fig2) and despite not showing obvious alterations in monocytes, when measuring the expression of adhesion molecules as sLex at low concentrations (0.001) the activation of its adhesion receptor was detected (Fig3). These data showed us that monocytes, when exposed to minimum concentrations of particulate matter, cause their activation, thus causing the release of pro-inflammatory cytosines that would trigger or intensify the inflammatory response.

In conclusion, the particulate material at very low concentrations is capable of activating human monocytes and increasing the expression of ligands of adhesion molecules, which triggers the increase in adhesion of endothelial cells and monocytes. Increasing the production of interleukins, TNF and ROS production.

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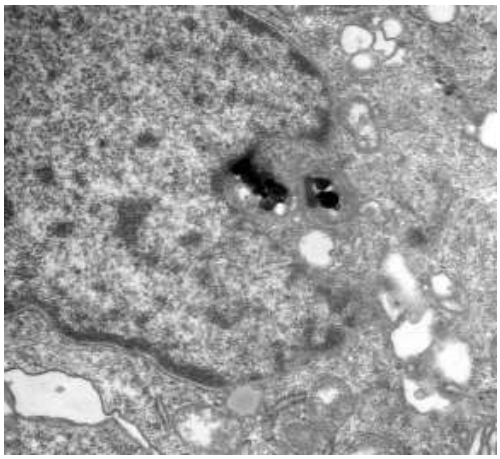

Fig. 1 Internalization of TiO_2 nano particles in endosomes. It is clearly seen how the TiO_2 nanoparticle is directed to the nucleus

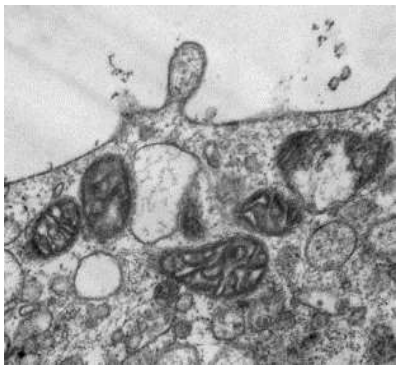

Fig. 2 PM10 adhered to monocyte membrane. The environmental particles adhered to the cytoplasmic membrane are observed.

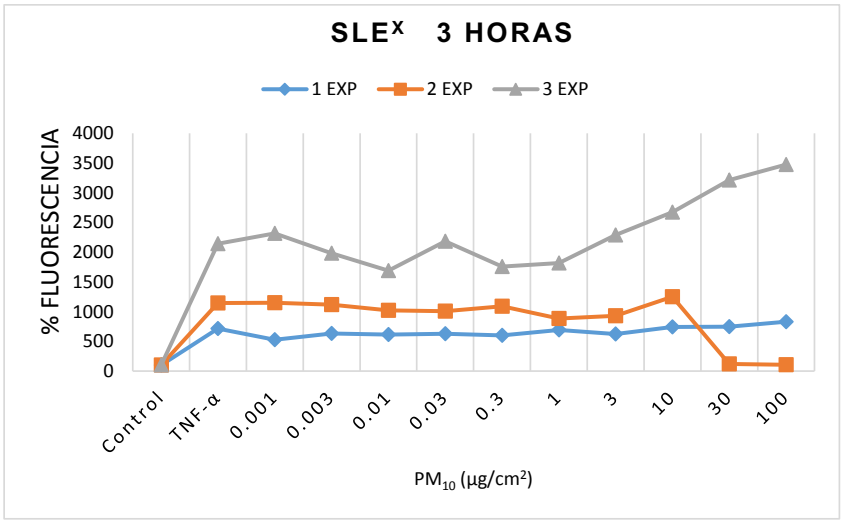

Fig. 3 We observed the expression of the sLex receptor in peripheral blood monocytic cells, exposed 1, 2 and 3, as a positive control TNF-∝ was used.

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