Impact of Nanoparticle Inhalation on Term Rat Placental Structure

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The placenta is a temporary but vital organ that supports fetal growth and development during pregnancy. It is the site of nutrient exchange and fetal growth is dependent on access to these nutrients from the maternal circulation. Due to the high blood flow, placentas are susceptible to damage by xenobiotic particles. Previous studies have indicated an association between fetal growth restriction and exposure to particulates. Sources of exposure include air pollution containing ultrafine particulate matter (<100 nm in diameter). Epidemiological evidence has associated particulate exposure during pregnancy with adverse outcomes. The purpose of this study was to evaluate changes to placental morphology after exposure to particulate matter, which may ultimately affect placental function and fetal development. Sprague Dawley rats were exposed to titanium dioxide aerosols during pregnancy (gestational day 6-19) to mimic exposure to ultrafine particulate matter. Placentas from both male and female fetuses were collected on GD 20, fixed in formalin, and prepared for histological examination using hematoxylin and eosin staining. Zen Blue software was used to measure the area of placental zones and maternal and fetal blood spaces. We observed a significant increase in the size of maternal blood spaces and decrease in the size of the decidua zone in exposed placentas compared to control. This observation was more pronounced in female derived placentas. Understanding how particulate matter exposure affects the placenta will enhance our knowledge of the potential human health outcomes associated with air pollution exposure during pregnancy.

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