Brain and olfactory dopaminergic pathways are impaired in rabbit pups daily exposed to diesel exhaust nanoparticules during gestation

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ABSTRACT BOOK

of the pollution for the fetus. Moreover, pediatricians may have a role to play because some neonates particularly exposed to pollution should perhaps benefit from a specific neurological and pulmonary monitoring.

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Airborne pollution, especially from diesel exhaust (DE), is known to negatively affect the nervous system (NS) of exposed human populations, either through systemic or airway pathways. However, the consequences of a gestational exposure to DE on the NS remain poorly explored. Therefore, an experimental model of gestational exposure of rabbit dams to DE nanoparticles that mimics conditions of exposure in human urban areas was developed to study the short- and long-term effects of such exposure on the developing NS. Pregnant does were exposed nose-only to clean air or to diluted (1mg/m3) filtered DE from gestational day 3 (GD3) to GD27, 2h/d, 5d/w [1]. At GD28, the presence of nanosize particles (20-48nm) was observed in the olfactory sensory neurons and the glomerular layer of the olfactory bulb (OB), along with cellular and axonal hypertrophy. Concomitant bulbar monoaminergic homeostasis disturbances, especially affecting the dopaminergic system, were also observed [2]. However, the neurotransmission pathways potentially affected by this gestational exposure and their long-term consequences have yet to be further explored.

To further investigate the effects of DE exposure with a focus on the dopaminergic system, the OB and brain of GD28 (8 controls; 8 exposed) and adult (8 controls; 10 exposed) rabbits were collected. The monoaminergic pathway was analyzed using immunohistochemistry and chromatography analysis in order to assess the anatomical and functional continuum between the olfactory system and other central structures of the brain at these two states.

At GD28, the histological analysis of the OB showed an increase in the TH-labeling intensity per cell in exposed fetuses without any increase in the number of dopaminergic neurons. At the adult stage, OB of exposed animals exhibited higher levels of dopamine and its metabolites (DOPAC and HVA). Within the brain of the same rabbits, the cytochrome oxidase activity, a marker of energetic metabolism, and the TH-labeling intensity were increased in the ventral tegmental area (VTA), a key area which is implicated in the reward circuitry of the brain, whereas both markers remained unchanged in the dopaminergic pars compacta of the substantia nigra which plays a role in the regulation of the fine motor control.