Deleterious Effects of Air Pollution on the Respiratory Epithelium.

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The air we breathe is becoming more and more toxic. Despite all studies and warnings from the scientific community on the subject, air pollution has been negligence as a morbidity factor and is making victims in megacity in the world. The worsening air quality in metropolitan areas is directly related to vehicular emissions, especially to fossil fuels vehicles.

In São Paulo City (Brazil), more than 6 million diesel-powered vehicles discharge approximately 1 ton of particulate matter into the air among other substances (Martins *et al*. 2017). These particles cause exacerbation of pre-existing diseases involving the airways such as COPD and asthma. In addition, the particulate matter, called PM 2.5 and PM 0.1, is able to penetrate the microcirculation, cross the alveolar barrier and cause cardiovascular, neurological and placental diseases with serious consequences on human health (Saldiva *et al*. 2002, Pope and Dockery 2006, Delfino *et al*. 2009 and Tsukue *et al*. 2010). In the atmosphere, more than 3000 different chemical components are identified, including a wide variety of mutagens and carcinogens, harmful to plants, animals and humans.

Several studies have been made pointing to pollution as one of the factors that cause cardiovascular diseases (Akinaga *et al*. 2009 and Santos *et al*. 2008), others associate the increased incidence of mutagenesis in plants and increased frequency of mortality due to cardiovascular diseases and cancer, to high levels of air pollution (Mariani *et al*. 2009 and Poirier, 2017).

Recent studies have pointed to air pollution as an isolated cause of lung cancer (Nafstad *et al*. 2003). Among other pollutants, SO_2, NO and NO_2 are routinely measured parameters to describe air quality. Organic extracts took from particulate matter contain mutagenic chemical components of different origins, according to the site studied, and the concentration of NO is a strong indicator of the pollution emitted by vehicles and the mutagenic activity induced by air pollution. Nitrogen dioxide (NO_2) is emitted directly into the atmosphere by vehicle exhausts, fertilizer industries, etc. NO_2 is an aggressive gas to the respiratory tract and its presence in the environment is related to cases of respiratory infections; in addition, it can be converted into the lungs into nitrosamines, some of which are known to be potentially carcinogenic. This gas can participate of a series of photochemical reactions in the atmosphere, for example, in the formation of the photochemical "smog", which reduces visibility.

The Ozone (O_3) is a colorless gas that is found in two distinct layers of the atmosphere: in the stratosphere, naturally formed by the photolysis of O_2. It protects life on earth by absorbing the ultraviolet radiation from the sun that reach-

es this layer. Moreover, in the troposphere ozone is formed through a complex series of reactions involving volatile organic compounds and nitrogen oxides, in the presence of sunlight. In this layer, it affects the health of the populations, irritating the respiratory system and may cause worsening of asthma and chronic pulmonary obstructive diseases (COPD). Epidemiological studies show that daily variations of fine and ultrafine particles are associated with morbidity and mortality rates in the population, mainly causing toxic effects on respiratory and cardiovascular tract (Pinheiro *et al*. 2014 and Traboulsi *et al*. 2017).

Many studies have related pollution with increasing mortality rates in the elderly, newborns and people with chronic diseases (Lin *et al*. 1999, Braga *et al*. 2001, Lin *et al*. 2004 and Farhat *et al*. 2005). Particulate matter from the exhaust of diesel engines is formed by a complex and variable mixture of organic and inorganic components, the most important being polycyclic aromatic hydrocarbons (PAHs) and metals (Vasconcellos *et al*. 2003, Carvalho-Oliveira *et al*. 2005, Laks *et al*. 2008 and De Siqueira-Bueno *et al*. 2010). Metals are responsible for reactions that generate oxidizing substances and induce inflammation and methylation of DNA. PAHs, in addition to inducing oxidative stress and inflammation, have a chemical structure very similar to estrogens and can induce effects such as obesity, increased peripheral resistance to insulin and microbial alteration, in addition to pro-neoplasic effects (Calahan *et al*. 2017, Alderete *et al*. 2017).

Air pollution causes the destruction and malfunction of the mucociliary apparatus through changes in the functioning of the mitochondria and the cytoskeleton (Seriani *et al*. 2015). Such exposure may also affect gene expression and induce apoptosis and anti-apoptosis with impacts on the regeneration of the bronchial epithelium (Seriani *et al*. 2015).

In summary, there are numerous evidences of the deleterious effects of environmental pollution on our organism. We need to urgent action to improve air quality in large cities.

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