

Air pollution and diabetes mellitus

Shih-Chun Pan¹, Yi-Chuan Chen¹, Weishan Chin², Yue Leon Guo^{1,3,4*}

Affiliations

¹ National Institute of Environmental Health Science, National Health Research Institutes, No. 35, Keyan Rd., Zhunan Town, Miaoli County 35053, Taiwan.

² School of Nursing, College of Medicine, National Taiwan University (NTU), No.1, Ren-Ai Rd. Sec. 1, Taipei 10051, Taiwan.

³ Environment and Occupational Medicine, College of Medicine, National Taiwan University (NTU) and NTU Hospital, No.1, Ren-Ai Rd. Sec. 1, Taipei 10051, Taiwan.

⁴ Graduate Institute of Environmental and Occupational Health Sciences, College of Public Health, NTU, Taipei, Taiwan.

*Correspondence: leonguo@ntu.edu.tw; Tel: +886-2-33668216

Both particulate matter (PM) and gaseous air pollutants, e.g., nitrogen oxides have been reported to associate with the risk of DM and gestational DM (GDM). However, inconsistencies in research findings are present in human studies. A proposed mechanism is that exposure to air pollution triggers the release of inflammatory cytokines or mediators (e.g., TNF- α , IL-6, C-reactive protein), with the increased inflammatory response subsequently contributing to insulin resistance. Chronic insulin resistance results in β -cell dysfunction which induces increased risk of DM. Exposure to PM and traffic-related air pollutants (TRAP) was also found that contributes to the risk of DM-related macro- and micro-vascular diseases, including cardiomyopathy, stroke, nephropathy and retinopathy. Mechanistically, oxidative stress, systemic inflammation, and elevated serum cytokines caused by air pollutants are related to endothelial cell dysfunction, vasoconstriction, and atherosclerosis progression. Due to the ubiquitous nature of exposure to air pollution, development of preventive strategies against air pollution-related DM and DM complication has not been easy, except for reduction of exposure through tightened air quality standards and environmental control. Other measures can include,

1. More careful health promotion activities among those with risk factors of DM, and among those with GDM, for the prevention of DM occurrence;
2. Active treatment of DM to prevent occurrence of the macrovascular and microvascular complications;
3. Personal protective equipment or indoor protection such as filtering masks and air cleaning devices while a period of high air pollution levels is predicted;
4. Enhancing Effect-modifying environments, such as increasing greenness in the

residential surroundings.

Further investigation to determine the effectiveness of preventive strategies for the prevention of air pollutant-related DM and DM complications are warranted.