

Air pollution increases risk of insulin resistance in children

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New research shows that growing up in areas where air pollution is increased raises the risk of insulin resistance (the precursor to diabetes) in children. The research is published in *Diabetologia*, the journal of the European Association for the Study of Diabetes (EASD), and is by Elisabeth Thiering and Joachim Heinrich, Helmholtz Zentrum München, Neuherberg, Germany, and colleagues.

Previous studies have identified links between [air pollution](#) and other chronic conditions such as atherosclerosis and heart disease. However to date, [epidemiological studies](#) that have examined associations between long-term exposure to traffic-related air pollution and [type 2 diabetes](#) in adults are inconsistent, and studies on [insulin resistance](#) in children are scarce. Thus this new study sought to explore the possible association between air pollution and insulin resistance in children.

"Although toxicity differs between air pollutants, they are all considered potent oxidisers that act either directly on lipids and proteins or indirectly through the activation of intracellular oxidant pathways," says Heinrich.

"[Oxidative stress](#) caused by exposure to air pollutants may therefore play a role in the development of insulin resistance. In addition, some studies have reported that short-term and long-term increases in particulate matter and nitrogen dioxide (NO₂) exposure lead to elevated inflammatory biomarkers, another potential mechanism for insulin resistance."

In this new study, fasting blood samples were collected from 397 10-year-old children within a follow-up of two prospective German [birth cohort](#) studies. Individual-level exposures to traffic-related air pollutants at their birth address were estimated by analysing emission from road traffic in the neighbourhood, population density and land use in the area, and the association between air pollution and insulin resistance was calculated using a model adjusted for several possible confounders including socioeconomic status of the family, birthweight, pubertal status and BMI. Models were also further adjusted for second-hand smoke exposure at home.

The researchers found that in all crude and adjusted models, levels of insulin resistance were greater in children with higher exposure to air pollution. Insulin resistance increased by 17% for every 10.6 $\mu\text{g}/\text{m}^3$ (2 standard deviations [SDs] from the mean) increase in ambient nitrogen dioxide (NO_2) and 19% for every 6 $\mu\text{g}/\text{m}^3$ (2 SDs) increase in particulate matter of up to 10 μm in diameter. Proximity to the nearest major road increased insulin resistance by 7% per 500 metres. All the findings were statistically significant.

Heinrich says: "There is some evidence that air pollution is associated with lower birthweight and growth restrictions—also shown previously in one of the cohorts of the present study—which are known risk factors for type 2 diabetes. Thus, one may speculate that lower birthweight is an intermediate step or 'phenotype' between air pollution and insulin resistance. However, we found no evidence to suggest that this may be true in our cohort of children, all of whom had birthweights above 2.5kg."

He concludes: "To our knowledge, this is the first prospective study that investigated the relationship of long-term traffic-related air pollution and insulin resistance in children. Insulin resistance levels tended to increase with increasing air pollution exposure, and this observation remained

robust after adjustment for several confounding factors, including socioeconomic status, BMI and passive smoking."

Currently, the 15 year follow-up of both cohorts is ongoing and the authors are planning to investigate how their findings translate into older age during or after puberty. "Moving from a polluted neighbourhood to a clean area and vice versa would allow us to explore the persistence of the effect related to perinatal exposure and to evaluate the impact of exposure to increased air pollution concentration later in life," says Heinrich. "Whether the air pollution-related increased risk for insulin resistance in school-age has any clinical significance is an open question so far. However, the results of this study support the notion that the development of diabetes in adults might have its origin in early life including environmental exposures."

Provided by Diabetologia

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