BPA and Insulin Resistance

Evidence of Effects in Dams and Offspring

Recent population studies have associated increased exposure to persistent organic pollutants with an elevated risk of insulin resistance and thus a greater likelihood of developing type 2 diabetes and heart disease. Among these chemicals is bisphenol A (BPA), a pervasive endocrine-disrupting compound used to make polycarbonate plastic and epoxy resins. Now researchers report evidence that exposure to environmentally relevant doses of BPA during pregnancy may alter insulin sensitivity and glucose homeostasis in mice, with potential disease-related consequences for both the mother and her male offspring [***EHP* 118(9):1243–1250; Alonso-Magdalena et al.**].

The study evaluated the effects of two different doses of BPA (10 or 100 µg/kg/d) administered to pregnant mice during days 9–16 of gestation. Glucose metabolism experiments were performed on the mice during pregnancy and subsequently on their offspring.

BPA exposure aggravated the insulin resistance that occurs during pregnancy, and four months postpartum, BPA-treated mice weighed more and had more severe insulin resistance than untreated females. The BPA-treated mice also showed elevated plasma levels of insulin, leptin, triglycerides, and glycerol (a breakdown product of triglycerides), as well as molecular changes indicating reduced insulin sensitivity in skeletal muscle and liver.

Given that levels of the hormone leptin are normally increased during pregnancy, the authors propose that future research should seek to determine whether BPA directly regulates leptin release from fatty tissue or whether the observed hyperleptinemia is a consequence of the altered metabolic state of these animals.

Previously the same research team had shown a relationship between BPA exposure and glucose intolerance and insulin resistance in adult male mice. In the present study, they further observed that, at 6 months of age, male offspring exposed to BPA *in utero* had reduced glucose tolerance, increased insulin resistance, and altered blood parameters compared with offspring of untreated mothers. Moreover, studies of the male offspring's pancreases showed altered calcium signaling and insulin secretion.

The authors conclude that BPA exposure during pregnancy can alter the mother's glucose metabolism during pregnancy and later in life, and may contribute to metabolic disorders relevant to glucose homeostasis in the male offspring. The findings also suggest that BPA exposure should be further examined as a risk factor for diabetes.

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Traffic Trouble

Study Links Diabetes to Vehicular Pollution

There is a well-documented relationship between exposure to particulate matter (PM) in ambient air pollution and risk of developing cardiovascular disease. Subclinical or low-grade inflammation, believed to serve as an intermediary between air pollution and cardiovascular/metabolic health risks, is associated with impaired glucose metabolism, but few studies to date have examined the relationship between air pollution and diabetes. For the first time, a prospective study provides evidence linking exposure to traffic-related air pollution with an increase in the risk of developing type 2 diabetes in women [***EHP* 118(9):1273–1279; Krämer et al.**].

In the current study, researchers investigated the relationship between air pollution exposure and new-onset incident type 2 diabetes using information from the prospective Study on the Influence of Air Pollution on Lung, Inflammation, and Aging (SALIA). The authors also assessed whether baseline inflammation was associated with pollution exposure.

The SALIA cohort is composed of 1,775 women aged 54–55 years without diabetes at enrollment. The women lived in the highly industrialized Ruhr district of Germany or in rural, nonindustrial towns nearby. Using data obtained from cross-sectional surveys administered in 1985–1994 and a follow-up interview in 2006, the investigators analyzed the incidence of type 2 diabetes over 1990–2006. They also collected information on symptoms and diagnoses of respiratory disease, home and occupational exposure to air pollution, smoking status, and socioeconomic status. They took initial height and weight measurements, and collected nonfasting blood serum samples to measure complement factor C3c, a blood protein that served as a marker for subclinical inflammation. They estimated exposure to nitrogen dioxide (NO_2) and PM, the major components of traffic emissions, by applying land-use regression models.

Between 1990 and 2006, 187 participants (10.5%) were diagnosed with type 2 diabetes. Exposure to traffic-related air pollution and higher levels of C3c in the blood at baseline were both associated with increased diabetes risk. Living within 100 m of a busy roadway was associated with more than double the risk of diabetes for women with a lower education level compared with women in the same group who did not live near a busy roadway; women with higher education who lived near busy roads had no altered risk.

Overall, the researchers observed significant associations with PM and NO_2 exposure. The slightly stronger associations of risk with NO_2 exposure than with PM exposure further support a link between traffic-related air pollution exposure and diabetes, since most sources of NO_2 are traffic-related.

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Caro/Alamy