

Benzene in Pregnancy – A Hidden Threat to Children’s Health

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January 11, 2025

STORY AT-A-GLANCE

- › Benzene is a pervasive environmental toxin found in automobile exhaust, industrial emissions, cigarette smoke, personal care products, household cleaners, paints and even some disposable goods like diapers and tampons
- › Benzene exposure during pregnancy is linked to metabolic disorders in offspring, with male offspring showing greater susceptibility to glucose intolerance and insulin resistance
- › Both male and female offspring exposed to benzene in utero experience impaired energy homeostasis, indicating disruptions in their ability to balance energy intake and expenditure
- › Benzene is a Group 1 carcinogen also linked to leukemia, Non-Hodgkin lymphoma and multiple myeloma, causing DNA damage, oxidative stress and chromosomal abnormalities even at low exposure levels
- › Key strategies for reducing benzene exposure include using air purifiers, choosing organic, natural alternatives, improving your home’s ventilation, storing chemicals properly and limiting time in high-traffic areas

Benzene, a pervasive environmental toxin, is present in automobile exhaust, industrial emissions and even cigarette smoke, putting millions at risk of daily exposure. Alarmingly, increasing evidence indicates that benzene exposure during pregnancy disrupts the metabolic health of children.

In 2019, a study published in *Toxicological Sciences*¹ showed that mice exposed to 50 parts per million (ppm) of benzene exhibited a 13% rise in fasting plasma glucose and a 39% rise in insulin levels compared to unexposed controls. These changes indicate that benzene impairs glucose regulation, forcing the pancreas to overcompensate.

Moreover, their HOMA-IR scores, a marker of insulin resistance, were significantly elevated in benzene-exposed mice. Insulin-stimulated Akt phosphorylation, an essential step for glucose uptake and utilization, was also severely impaired, highlighting a major disruption in insulin signaling pathways.

A subsequent study, published in the same journal in January 2021, supports these findings, revealing that maternal benzene exposure during pregnancy predisposes offspring to long-term metabolic imbalances and sets the foundation for serious health issues later in life. As urbanization and industrial activities continue to rise, understanding and mitigating benzene exposure becomes essential in preventing a surge in metabolic disorders in future generations.

Long-Term Impact of Prenatal Benzene Exposure on Offspring Metabolic Health

The January 2021 study in *Toxicological Sciences*² examined how prenatal exposure to benzene influences glucose metabolism, insulin resistance and overall energy balance in the offspring as they reach adulthood.

Pregnant C57BL/6JB mice were exposed to benzene at a concentration of 50 ppm (considered high-level exposure) or to filtered air as a control for six hours daily from gestational day 0.5 to 21, and their offspring were monitored for metabolic health indicators as they matured.

The findings revealed significant disruptions in energy homeostasis in both male and female offspring by 4 months of age. These disruptions included reduced oxygen consumption (VO₂), carbon dioxide production (VCO₂) and heat production.

However, the effects on glucose metabolism and insulin sensitivity were more severe in male offspring. By 4 months, only male offspring from benzene-exposed mothers exhibited glucose intolerance and insulin resistance, while females remained unaffected.

At 6 months, both sexes displayed marked glucose intolerance, but severe insulin resistance remained predominantly in the male group. Male mice also exhibited elevated insulin secretion and increased beta-cell mass, indicating the pancreas's effort to manage insulin resistance. Their HOMA-IR index was also significantly elevated, further highlighting their heightened vulnerability.

Both sexes exhibited increased expression of hepatic genes related to inflammation and endoplasmic reticulum (ER) stress, pointing to systemic cellular stress and inflammation as key mechanisms driving metabolic imbalances. In males, the combination of disrupted glucose metabolism, elevated insulin secretion and increased beta-cell mass highlighted the body's attempt to counteract insulin resistance, exacerbating their risk.

The biological mechanisms behind these findings involve benzene's impact on gene expression related to glucose metabolism and inflammation. By altering the expression of these genes, benzene disrupts the body's ability to maintain energy balance and effectively utilize glucose, leading to insulin resistance.

Interestingly, prenatal benzene exposure did not significantly alter body weight or composition in offspring. This finding suggests that the metabolic disturbances observed were not linked to changes in body mass but rather to functional impairments in energy and glucose metabolism. The authors noted:

“Metabolic imbalance in offspring was independent of body weight changes and was associated with impaired energy homeostasis and glucose metabolism, affecting both sexes, although the effect was more severe in adult male offspring. Our data provide a link between early life exposure to an environmental pollutant and the risk for developing metabolic syndrome later in life (in offspring).”³

Benzene Is Also a Known Carcinogen

Aside from increasing the risk of metabolic problems during adulthood, benzene exposure is well-established as a major contributor to cancer risk. Classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC),⁴ benzene is strongly linked to hematologic cancers such as leukemia, particularly acute myeloid leukemia (AML).⁵

This link has been observed both in occupational settings, where workers are exposed to high levels of benzene, and in individuals with prolonged exposure to lower concentrations through air pollution. Benzene affects the body by damaging bone marrow, which is vital for producing healthy blood cells. It causes chromosomal abnormalities in hematopoietic cells, leading to mutations that increase the likelihood of developing leukemia.⁶

Epidemiological studies have consistently shown a dose-response relationship, meaning that the higher the exposure to benzene, the greater the risk of developing cancer. Even low-level exposure in urban areas has raised concerns about cumulative risks over time,⁷ especially in vulnerable populations like pregnant women and children.

Beyond leukemia, benzene has been implicated in other cancers, including Non-Hodgkin lymphoma and multiple myeloma. Its metabolites, such as benzene oxide and hydroquinone, are highly reactive and capable of causing DNA damage, oxidative stress and cell cycle disruptions, all of which contribute to cancer development.⁸

Benzene Is Present in Other Household Products

Benzene's reach extends far beyond air pollution, cigarette smoke and industrial emissions — it's also found in numerous household and personal care products. A recent report in *The New York Times*⁹ highlighted the presence of benzene in popular personal care items, including sunscreens, deodorants, dry shampoos, acne creams and even hand sanitizers.

The report explained that benzene is not intentionally added to these products but it contaminates them during manufacturing, particularly when ingredients are not adequately purified or degrade over time. Aerosol products, such as sprays, are particularly concerning because benzene is introduced through contaminated propellants, increasing the risk of inhalation during use.

Skincare and body care products carry a dual risk, with benzene entering the body through the skin or being inhaled during application. Ingredients in lotions, sunscreens and acne treatments that are designed to enhance absorption also inadvertently accelerate benzene uptake. While the levels detected in these products are often low, experts are concerned about the cumulative exposure from daily use.

Beyond personal care items, benzene is also present in household cleaning products, paints, varnishes, adhesives and air fresheners. Burning scented candles or using aerosol air fresheners release benzene into indoor air, as do improperly stored plastic and rubber items. Even disposable goods like diapers, sanitary pads and tampons have been found to contain traces of this chemical and its derivatives.

Eight Ways to Protect Your Family from Benzene Exposure

The evidence linking benzene exposure to long-term metabolic problems and health risks emphasizes the importance of creating a safe, toxin-free environment for your family. By taking proactive measures, you'll be able to significantly reduce exposure and support your child's metabolic health from the earliest stages. Here are some practical strategies I recommend you adopt:^{10,11,12,13}

- 1. Improve your home's indoor air quality** — Invest in high-quality air purifiers equipped with high efficiency particulate air (HEPA) and activated carbon filters to reduce benzene and other volatile organic compounds (VOCs) from indoor air. If you live in urban areas or near industrial zones, install ventilation systems that filter outdoor air pollutants. Moreover, regularly air out your home to enhance air circulation.

- 2. Choose safer personal care products** – Switch to non-aerosol formulations for personal care products like dry shampoos, deodorants and body sprays, as aerosols are more likely to be contaminated with benzene through propellants.

Look for labels indicating organic or benzene-free formulations to ensure safer choices. Better yet, opt for all-natural alternatives such as body care products made with organic, simple ingredients like shea butter, coconut oil or essential oils.

- 3. Eliminate hidden toxin sources in your home** – Replace high-VOC paints, varnishes and adhesives with low-VOC or VOC-free alternatives to minimize benzene exposure during home improvement projects. Moreover, avoid using scented candles, air fresheners or fragranced household products. Instead, use natural alternatives like essential oil diffusers, beeswax candles or simmering herbs and spices for a safer way to freshen your home.

- 4. Store chemicals safely** – Keep any essential chemical products tightly sealed in outdoor, well-ventilated storage spaces such as garages or sheds, far from living areas, to minimize the risk of indoor air contamination.

- 5. Optimize nutrition to support detoxification** – Eating an organic, nutrient-dense, whole-food diet is essential for supporting your body's natural detoxification processes and reducing oxidative stress. It's wise to incorporate sulfur-rich foods, such as pasture-raised eggs, garlic, onions and cruciferous vegetables like broccoli and kale, into your diet, as they play a key role in enhancing liver function and detox pathways.

At the same time, avoiding processed foods and vegetable oils is essential, as they impair cellular energy production and increase the body's toxic load. Staying hydrated with filtered water further helps your body flush out toxins effectively, ensuring your detox systems work at their best.

- 6. Minimize your outdoor exposure** – On high-pollution days, keep windows closed and limit outdoor activities, particularly during peak traffic hours when benzene

emissions are at their highest. Avoid spending time in high-traffic areas and near industrial zones, where vehicle and industrial emissions are most concentrated.

When refueling your vehicle, use well-ventilated locations, and never idle your car near your home or in enclosed spaces to prevent benzene fumes from accumulating. Additionally, quit smoking and avoid areas where secondhand smoke is present, as cigarette smoke is a significant source of benzene exposure.

- 7. Stay informed** – Regularly check safety alerts and product recall reports from the U.S. Food and Drug Administration’s (FDA) and Environmental Protection Agency (EPA) to stay updated on products known to contain benzene. Additionally, monitor local air quality levels and use apps or online resources to adjust activities based on pollution conditions in your area. This will help you plan for cleaner air times when outdoor activities are safer.

- 8. Advocate for safer policies** – Support policies aimed at reducing industrial benzene emissions, improving vehicle exhaust standards and creating safer urban spaces to protect the environment and public health.

Sources and References

- ¹ [Toxicological Sciences, Volume 167, Issue 2, February 2019, Pages 426-437](#)
- ^{2, 3} [Toxicological Sciences, Volume 180, Issue 2, April 2021, Pages 252-261](#)
- ⁴ [IARC, Benzene \(PDF\)](#)
- ^{5, 11} [American Cancer Society, Benzene and Cancer Risk](#)
- ⁶ [Carcinogenesis. 2011 Dec 12;33\(2\):240-252](#)
- ⁷ [Front Public Health. 2024 May 14;12:1355739](#)
- ⁸ [Toxicol Rep. 2014 Nov 4;1:1096-1105](#)
- ⁹ [The New York Times, December 5, 2024](#)
- ¹⁰ [Cancer Prevention Daily, 8 Things You Can Do to Avoid or Minimize Benzene Exposure](#)
- ¹² [WHO, Exposure to Benzene: A Major Public Health Concern](#)
- ¹³ [OSHA, Benzene](#)