

High stress during pregnancy linked to elevated cortisol in toddlers' hair

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Researchers at Washington University in St. Louis and Dartmouth College have discovered a connection between toddler hair cortisol levels—a long-term stress biomarker—and maternal prenatal depression.

The findings, [published](#) in the *American Journal of Human Biology*, suggest that a child's long-term stress physiology—or how the body responds to stress—may be influenced by conditions experienced in utero, according to study co-author Theresa Gildner, an assistant professor of biological anthropology in Arts & Sciences at WashU.

The findings also highlight the potential for hair cortisol—a minimally invasive and easy-to-collect measure—to assess infant and toddler cortisol activity.

"Hair cortisol tests are less invasive than blood tests, the standard cortisol measurement technique, and more useful than saliva tests, which only reflect short-term changes in cortisol. With 1 centimeter of hair corresponding to roughly one month of cortisol incorporation, hair cortisol tests can quantify cumulative cortisol exposure over extended periods of time," Gildner said.

According to Gildner, the study was primarily conducted for research purposes, but it also has potential clinical applications.

"By understanding the long-term effects of maternal stress on her offspring and when these effects are especially pronounced during pregnancy, we can better determine when interventions to support parents and reduce stress are most needed, as well as the potential long-term benefits of investing in these kinds of interventions to support both maternal and infant well-being," Gildner explained.

How maternal cortisol impacts offspring

The hypothalamic pituitary adrenal (HPA)-axis is the body's system for managing stress. When the body encounters stress, the HPA-axis releases a steroid hormone called cortisol. Cortisol levels naturally fluctuate throughout the day and in response to stress, but generally come back

down once the threat passes.

Chronic stress, however, can disrupt the HPA-axis activity, causing [cortisol levels](#) to remain elevated. This can lead to serious health problems, including metabolic disease, immune system dysfunction, increased inflammation, cancer and mental health conditions.

During pregnancy, cortisol readily crosses the placenta. When a pregnant person's cortisol level remains high, it can also harm the fetus and affect development, including fetal growth rate.

"Changes in offspring cortisol levels could potentially be beneficial, possibly leading toward accelerated growth and development in response to early adversity. Basically, the baby is receiving signals in utero from mom that the outside world is stressful, and their growth patterns might adjust in response," Gildner said.

"However, these changes might also have negative costs for the child, including lower birth weight and issues later in life, such as increased [behavioral problems](#) and elevated risk of developing cortisol-associated health conditions, such as depression, anxiety, digestive problems and weight gain."

Interestingly, maternal depression did not have the same long-term impact on mothers. The researchers also tested maternal cortisol production 15 months after birth, but they did not find the same connection. They also did not find a connection between postnatal depression and offspring cortisol levels, suggesting only direct exposure during pregnancy affected the offspring.

The present study was a relatively small study of 46 mothers and 40 toddlers, averaging 15 months of age, but the results are encouraging. Gildner said they hope to build on this study, recruiting a larger sample

and continuing testing later in life.

"This could help us understand how long the effect of maternal depression exposure in utero might last," Gildner said.

More information: Zaneta M. Thayer et al, Toddler hair cortisol levels are associated with maternal prenatal depression, *American Journal of Human Biology* (2024). [DOI: 10.1002/ajhb.24127](https://doi.org/10.1002/ajhb.24127)

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