

Study finds smoking during pregnancy alters newborn stress hormones and DNA

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Researchers from The Miriam Hospital have studied the effects of smoking during pregnancy and its impact on the stress response in newborn babies. Their research indicates that newborns of mothers who smoke cigarettes during pregnancy show lower levels of stress hormones, lowered stress response, and alterations in DNA for a gene that regulates passage of stress hormones from mother to fetus. The study and its findings have been published in the journal *Psychoneuroendocrinology*.

"Our results suggest that these newborns may not be mounting adequate hormonal response to daily stressors. Their stress systems may not be prepared for the stressors of daily life," says lead researcher Laura Stroud, Ph.D., of the Centers for Behavioral and Preventive Medicine at The Miriam Hospital. "This may be particularly detrimental in babies born to mothers who lack resources and parenting skills and whose babies may encounter more daily stressors."

National health statistics show that despite the warnings and known health risks, approximately one in 10 expectant moms in the United States continue to smoke during pregnancy, with higher rates among young, poor, and underserved moms. Babies born to [smoking mothers](#) are born smaller, are more likely to be premature, and are at greater risk for medical complications. Smoking during pregnancy is also associated with long-term behavioral and health problems in child and adult offspring, including asthma, behavior and attention problems, and nicotine addiction. However, biological mechanisms underlying short and long-term effects of smoking during pregnancy on offspring are not well understood.

"One possibility is alterations in stress hormones and [epigenetic changes](#) (chemical modifications) in DNA" Stroud says. "We were interested in stress hormones because alterations in stress hormones have been linked to both smoking and behavior

problems and because maternal stress hormones during pregnancy exert potent long-term effects on offspring. In particular, we sought to investigate effects of smoking during pregnancy on the newborn [stress hormone cortisol](#)." Cortisol is part of the hypothalamic pituitary adrenocortical system that works synergistically with the "fight flight" stress system.

Stroud also investigated the effects of smoking during pregnancy on DNA in the placenta, the temporary organ joining the mother and fetus during pregnancy. Stroud was interested in studying epigenetic changes, or chemical modifications that turn genes on and off, in DNA for the glucocorticoid receptor gene that regulates passage of cortisol from mother to fetus.

Stroud's study included 100 mother-newborn pairs from a low-income, racially and ethnically diverse sample. Smoking in the mothers was examined through interviews that covered each day of pregnancy – with mothers' reports confirmed by measuring nicotine levels. After babies were born, placentas were collected and DNA was analyzed for alterations in the glucocorticoid receptor. Newborns' [cortisol levels](#) were measured during and after neurobehavioral exams (involving behavioral responses to different stimuli, reflex testing, and observation) conducted seven times over the first month of life.

Results showed that infants exposed to smoking showed lowered cortisol levels at baseline and in response to the neurobehavioral exam, a behavioral stressor. The lowered cortisol responses were consistent across seven behavioral exams over the first month of life. In addition, effects of smoking during pregnancy on infant cortisol and stress response were explained by alterations in DNA for a gene that regulates passage of cortisol from mother to fetus.

"Our results also suggest that effects of smoking

during pregnancy on infant stress response are explained by changes in DNA," Stroud says. "Because these DNA changes are epigenetic, there is a hopeful message that perhaps some of these changes could be undone by environment or medications."

Stroud concludes, "These alterations in [stress hormones](#), [stress response](#), and DNA may explain links between moms' smoking during pregnancy and the risk for their children to have behavior problems and nicotine addiction in later life. Our results offer one more reason for mothers to quit [smoking](#), and also highlight the need for early intervention with babies born to mothers who smoke during [pregnancy](#) and the mothers themselves."

Provided by Lifespan

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