

Low cortisol levels found in kids whose mothers show signs of depression

April 21 2008

A new study of young children living in extreme poverty found that those whose mothers showed symptoms of depression had low levels of cortisol, a hormone activated during times of stress, compared with children whose mothers did not exhibit depressive symptoms.

The researchers say the blunted cortisol levels they found in some children may indicate an adaptive response to chronic stress on the hypothalamic-pituitary-adrenal (HPA) system, which is responsible for producing hormones that help our bodies respond to stressful situations.

Cortisol is a corticosteroid hormone pumped out by the adrenal glands as part of a body's fight-or-flight response to stress. It raises blood pressure and blood sugar levels to help with quick bursts of energy, and is naturally found at higher levels in the early morning, declining to its lowest point at bedtime.

"Many people assume that the only way the body responds to constant stress is to produce too much cortisol, but repeated stress can also cause the HPA system to shut down so that you are not producing cortisol when you normally should," said Lia Fernald, assistant professor of community health and human development at the University of California, Berkeley, and lead author of the study.

The findings, appearing in the Spring 2008 issue of the journal *Development and Psychopathology*, highlight a biological effect in children who are facing not only economic deprivation, but also an

added risk of possible depression in a key caregiver, the researchers said.

"The unexpectedly low levels of cortisol we found are most likely an expression of chronic, intense, long-term stress on the HPA system," said Megan Gunnar, professor of child development at the University of Minnesota and co-author of the study. "Really high increases over a period of time end up driving the system to the ground."

Awareness of hypo-cortisol levels has grown in the past five to 10 years, said Gunnar, a developmental psychobiologist. The researchers said that depressed levels of cortisol have been seen a few times before in young children, including in studies of neglected children in Romanian orphanages and preschoolers who experienced repeated bouts of foster care beginning in infancy.

The few studies that have been done suggest a link between low cortisol levels in children and disruptive behavior disorders, including aggression.

This new study is part of a larger project studying social welfare interventions for low-income families in Mexico. Researchers focused on children in some of Mexico's poorest regions, areas identified through a baseline census of families across the country. The study's sample of 639 children, ages 2.5 to 5, live in a region where the median per capita income is \$730 per year, more than 14 times lower than the national figure in Mexico of approximately \$10,000 per year.

Approximately 40 percent of the children come from homes without electricity or running water, and many are from isolated indigenous communities.

In 2003, a research team of health professionals paid unannounced visits to homes in the low-income regions, providing verbal explanations of the goals and risks of research to participants and obtaining informed

consent from the mothers. The researchers conducted one-hour interviews with each mother that included a standard screening test used to assess symptoms of depression. Although the screening tool has not been extensively used in Mexico, it has been used in the United States, where a score of 16 or higher indicates that the respondent is at risk for clinical depression.

More than 60 percent of the mothers in the study scored above 16, with 10 percent scoring above 35.

At the same time the mother was being interviewed, the researchers selected one child, usually the eldest, to undergo cognitive tests. They also took three samples of saliva from the child throughout the hour to determine whether any significant changes in levels occurred during the visit, and they controlled for the time of day the sample was taken.

The initial saliva sample, collected approximately five minutes after arrival in the home, represented baseline cortisol levels, since it takes more than five minutes for stress activations of the HPA system to raise cortisol concentrations in saliva. It takes about 20 to 25 minutes for the hormone's secretion to reach peak levels.

The unexpected presence of strangers was used by researchers as a mild stressor for young children. The administration of standardized cognitive tasks to assess language and cognitive competence was a second mild stressor for the children.

These are situations in which it would be normal for cortisol levels to increase moderately, said Fernald.

The researchers found that for all children, higher maternal scores on the depression screening tool were linked to the youngsters' lower overall cortisol levels. The baseline values for salivary cortisol in the children

averaged 2.78 nanomoles per liter; about two to 2.5 times lower than what a typical middle class child in the United States would be showing at the same time of day.

"This study speaks to the fact that maternal depression, particularly when it goes along with poverty, really needs to be addressed," said Fernald. "Public health interventions typically focus on physical health, such as promoting immunizations and preventing malnutrition. However, we are seeing that a mother's mental health could be a critical factor influencing the physiology of their kids."

Moreover, the researchers found a greater impact of maternal depression symptoms on girls than on boys. Girls whose mothers had a greater number of depressive symptoms had the lowest baseline levels of cortisol.

"It is unclear why a larger effect was seen among girls, but I would suspect that it would be necessary to go beyond biology for an explanation," said Gunnar. "It may be related to the unique relationship between mothers and daughters, and the possibility that daughters often spend more time in the home."

"Maternal depression is very tough on little kids because it interferes with the mother's capacity to be responsive and supportive," added Gunnar. "On the flip side of that is that a mother who can provide supportive care can buffer her children from a lot of adversity. Other studies have shown that. But of course, it's hard to be sensitive and supportive to the demands of young children when you are struggling emotionally and physically with trying to live in extremely impoverished conditions."

The study was also co-authored by Heather Burke, assistant adjunct professor of psychiatry at UC San Francisco. It was supported by the

John D. and Catherine T. MacArthur Foundation Network on SES (Socioeconomic Status) and Health, the Fogarty International Center of the National Institutes of Health, and the National Institute of Mental Health.

Source: UC Berkeley

Citation: Low cortisol levels found in kids whose mothers show signs of depression (2008, April 21) retrieved 26 April 2024 from <https://medicalxpress.com/news/2008-04-cortisol-kids-mothers-depression.html>

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