Medical Xpress

Stress-induced events jumpstart sperm performance once the event has passed, research reveals

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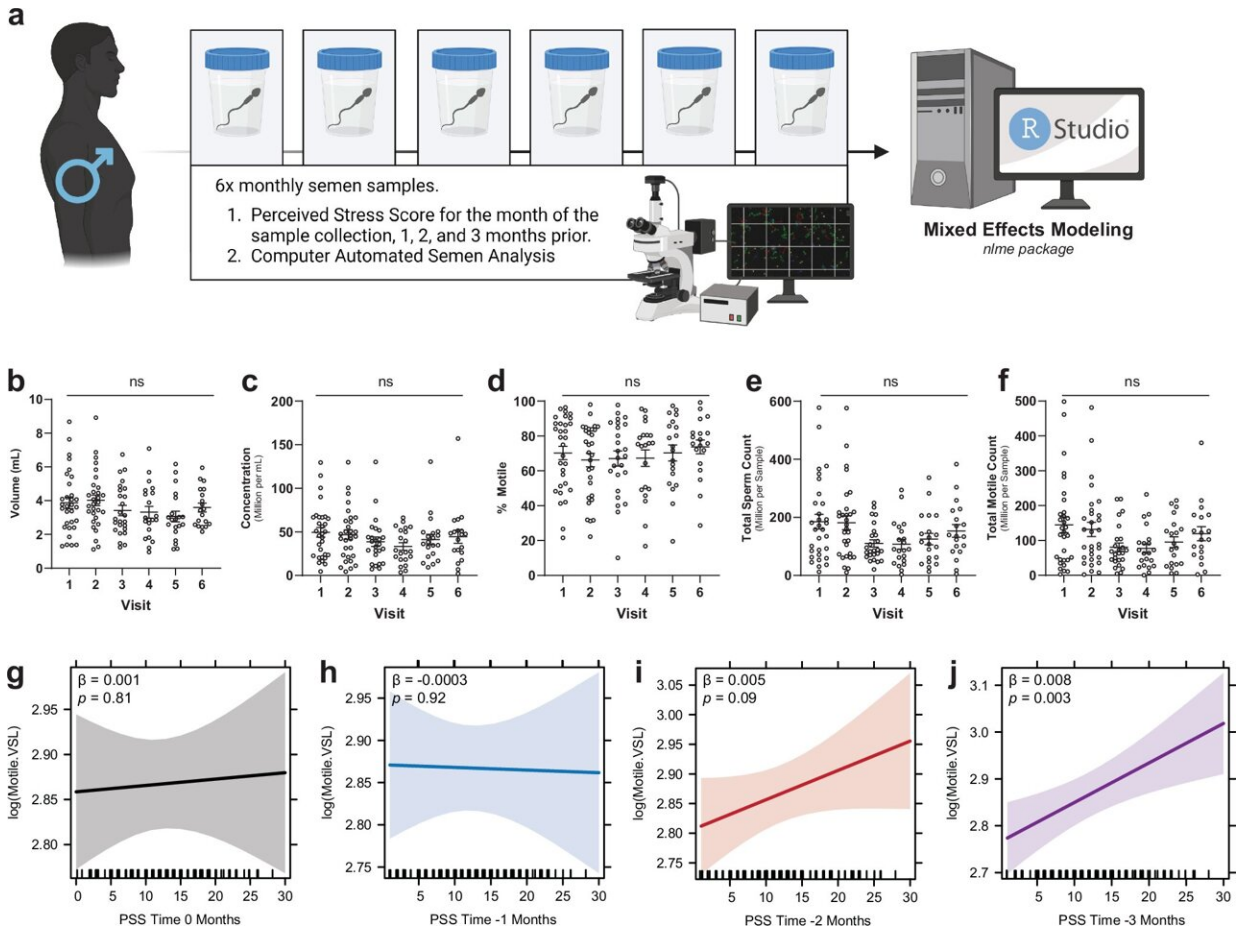

Sperm motility increased 2-3 months following elevated perceived stress in healthy men. Credit: *Nature Communications* (2024). DOI: 10.1038/s41467-024-52319-0

A study led by researchers at the University of Colorado Anschutz Medical Campus reveals that stress-induced changes in sperm motility occur after a stressful event, rather than during it and improves sperm performance. The discovery is essential in understanding how stress impacts the reproductive process to improve fetal development outcomes.

The study was published in *Nature Communications*.

Over the last five decades, there has been a notable decline in semen quality, which has coincided with environmental stressors. This new research identifies how stress affects the ability of sperm to move through a female's reproductive system to fertilize an egg (motility).

Researchers observed changes in extracellular vesicles (EVs), small particles released from the male reproductive tract that play a role in sperm development and maturation. These changes occurred after the stressor had passed, not during the stress experience.

"Our findings show a significant, time-dependent increase in sperm motility following perceived stress which aligns with previous studies on changes in the microRNA in human sperm," said Tracy Bale, Ph.D., lead author and the Anschutz Foundation Endowed Chair in Women's Integrated Mental and Physical Health Research at the Ludeman Center at CU Anschutz.

"This timing, where sperm function improves after stress, might be evolutionarily beneficial to increasing birth rates, particularly following challenging times like those experienced during the COVID pandemic."

Studies were conducted in both men and in animal models. In both cases, stress-induced EVs enhanced sperm motility and mitochondrial respiration, the chemical energy needed to power the cell's biochemical

reactions.

"Imagine you have a car that's struggling to get up a steep hill. When the engine is stressed, the car becomes less efficient. However, with a little more gas, you can boost the overall performance for a smoother drive. Just as your car becomes more efficient under stress, with the right adjustments, cells improve their energy production and movement when stress-induced factors are present," said Nickole Moon, Ph.D., the paper's first author and student at CU Anschutz who is on the research team.

Since the results were the same in both humans and in animal models, the findings suggest that this could be a universal coping mechanism across species, which might offer insights into broader reproductive health implications.

While the study focused on males, researchers highlight the importance of exploring how stress affects both partners in the fertility process. In addition, the researchers are ultimately interested in how these differences impact fetal development, especially for the brain.

"The impact of stress on germ cells, fertility, and the mechanisms underlying the transmission of parental stress experiences across generations are not well understood," said Neill Epperson, MD, professor and chair of the CU Department of Psychiatry and Bale's partner on the studies.

"By continuing to recruit participants for these trials and conducting thorough stress evaluations along with the work taking place in the lab, we aim to gain a deeper understanding of how past stressors may affect future offspring."

Bale reiterates how increasing awareness of how stress impacts

reproduction is vital.

"As stress is a common part of daily life, understanding its effects on reproduction and development will be essential for improving fertility and addressing broader ecological impacts on endangered species," said Bale.

The team is conducting additional studies that focus on understanding how stress information is transmitted into EVs and how this influences fertilization. They are also exploring the impact on brain development. In addition, they will be launching a trial study to test this model and further investigate the relationship between EVs and sperm in seminal fluid.

More information: Moon, N., et al. Stress increases sperm respiration and motility in mice and men. *Nature Communications* (2024). DOI: 10.1038/s41467-024-52319-0

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