



# Female lower back has evolved to accommodate strain of pregnancy

## Evolutionary differences in male and female spine

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According to a new study by researchers at Harvard and the University of Texas at Austin, women's lower spines evolved to be more flexible and supportive than men's to increase comfort and mobility during pregnancy, and to accommodate the special biology of carrying a baby for nine months while standing on two feet.

The study published in the Dec. 13 edition of the journal *Nature* was led by Katherine Whitcome, a postdoctoral researcher in the Department of Anthropology in Harvard's Faculty of Arts and Sciences, with Daniel Lieberman, professor of anthropology at Harvard, and Liza Shapiro, associate professor of anthropology of the University of Texas at Austin.

"Pregnancy presents an enormous challenge for the female body," says Whitcome. "The body must change in dramatic ways to accommodate the baby, and these changes affect a woman's stability and posture. It turns out that enhanced curvature and reinforcement of the lower spine are key to maintaining normal activities during pregnancy."

It has long been appreciated that giving birth to large-brained infants has influenced human pelvic shape, but there has been little attention paid to the major challenge that pregnant bipedal mothers endure when holding up an enormous fetus and placenta well in front of the hip joints. The study is the first of its kind to examine the evolutionary



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Stephanie Mitchell/Harvard News Office

mechanisms that allow women to carry a baby to term, and the way that women's bodies compensate for increased weight in the abdomen during pregnancy.

Walking on two feet, which began early in [human evolution](#), presents a unique challenge during pregnancy because the center of gravity shifts far in front of the hips, destabilizing the upper body and impairing locomotion. This is not the case for animals that walk predominantly on four legs such as chimpanzees, or even other bipeds.

To accommodate this shifted center of gravity, women's spines have evolved to help offset the additional weight in the abdomen during pregnancy, so that the back muscles are not taxed in counter-balancing the destabilizing effects of the baby's weight.

In both women and men, the curvature of the [spine](#) in the lower back, called the lordosis, stabilizes the upper body above the lower body. The researchers studied 19 pregnant women between the ages of 20 and 40 and found that when naturally standing, the women lean back, increasing their lordosis by as much as 60 percent by the end of their term. In doing so, pregnant women maintain a stable center of gravity above the hips.

The research also demonstrates, for the first time, that human lumbar vertebrae differ between males and females in ways that decrease the shearing forces that the lumbar extension of pregnancy places on the lower back in pregnant mothers.

"In females, the lordosis is subtly different than that of males, because the curvature extends across three vertebrae, while the male lordosis curves across only two vertebrae," says Whitcome. "Loading across three vertebrae allows an expectant mother to increase her lordosis, realigning her center of gravity above her hips and offsetting the destabilizing weight of the baby."

In addition to the difference in the number of vertebrae across which

the lordosis spans, the female joints are relatively larger and flare out further down the spine than those of males, improving the spine's strength. All of this contributes to an increased ability to extend the spine, so that the woman can lean back, realign the body's center of gravity, and safely maintain a more stable position. These differences in the lower back may even reinforce her capability to support and carry her baby in her arms after the baby has been born.

When human ancestors first became bipedal, they set the human lineage off on a different evolutionary path from other apes, but in so doing created special challenges for pregnant mothers. One exciting discovery is that the ability of human females to better carry a baby to term while standing on two feet appears to have evolved at least two million years ago. The researchers studied two [hominin fossils](#) that were approximately two million years old, one of which - presumably a female - displayed three lordosis vertebrae and one of which - presumably a male - displayed fewer.

"Early human women lived very strenuous, active lives, and pregnant females were forced to cope with the discomfort of childbearing while foraging for food and escaping from predators," Lieberman says. "This evolution of the lower back helped early woman to remain more mobile during pregnancy, which would have been essential to survival, and appears to have been favored by natural selection."

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