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INSIDE JEB

Mouse mums consider their futures

Mouse mother with her litter. Photo credit: Creative Commons by Seweryn Olkowicz CC-BY-SA-3.0.

How do you tell if a mouse could eat more than what it actually eats, and why would it choose to eat less? These are the questions that John Speakman, from the University of Aberdeen, UK, has been running up against in his decades-long quest to understand the limits on how much an animal eats to fuel its activities. Speakman and his group have been using lactating mice to try to answer these questions, as new mothers require the endurance of extreme athletes. Given the high energy demands of feeding a bunch of growing hungry babies, one might expect that mouse mothers would eat as much as they can to raise their kids up big and strong. But, there appear to be limits to how much these mums eat, and figuring out whether the limits are physiological – i.e. the mice simply can't eat any more – or are a choice isn't easy. Speakman explains, 'It's a really hard question to answer. A somewhat easier question to answer is whether there is a credible reason for why a female might choose to restrain herself by eating less than she is physically or physiologically capable of.' One possibility is that mums might choose to eat less now because there's a benefit either for her future offspring or for her own future reproductive attempts.

To test this idea, Speakman's team took mice that had recently given birth and either increased or decreased their litter sizes. Half the mothers were given 16 pups, and half were given five. They found that mums who raised larger litters ate more food, but raised smaller pups; some even killed pups, reducing the size of their litter by about two. So, the mums with large litters were unable to keep up with the demands of the pups, even though they ate more than the other mums.

To see whether these differences in initial litter size had an effect on subsequent litters, the team allowed the mothers to mate again after the first pups were weaned, but this time, they didn't interfere with the sizes of the new litters. On average, the mums produced litters of the same size; however, the mothers that had previously produced large litters ate less than the mothers that had previously given birth to smaller litters, produced less milk and, again, raised smaller pups. The mothers that had had a lot of pups the first time around reduced their efforts the second time.

Then, when the team raised the first set of pups from both groups and bred them, they found that the new mums from the burdened, large litters had smaller offspring themselves. The toll taken on the mice who couldn't keep up with their kids' demands extended into the next generation.

Speakman says their results show that mice may not be pushing themselves to the limit every time they reproduce. The mice may eat less and, consequently, have fewer or smaller babies so that they can be sure to have more babies later: they perform a long-term energetic balancing act.

While these results may seem exciting considering the questions that have captivated Speakman for years, he says, 'Actually, it's more annoying than exciting. Most of our previous 26 papers have rested on the assumption that the female is not choosing her investment level. Now we have evidence that there is at least a reason why she might be. That doesn't mean that she is choosing – just a reason for her to do so.'

Speakman's team is currently testing whether mouse mums choose to energetically pump the brakes in anticipation of the future, but he suggests the implications of their completed study are much broader: 'Never assume you understand anything. We have worked on this system for over 20 years and it still throws up surprises.'

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