

INSIDE JEB

Deer mice mums prioritise themselves for high-altitude success



New-born pups from a high-altitude deer mouse mother. Photo credit: Cayleigh Robertson.

When it comes to feats of extreme endurance, achievements such as scaling Mount Everest and migrating pole to pole spring to mind. But for mammals, the reality of extreme exertion is more mundane. Producing milk to feed a litter of young is often the most metabolically demanding event that many mammals endure. Then add in exceptionally low temperatures with thin mountain air and you'll begin to see the scale of the task facing high-altitude deer mice. So how do these mini mountain dwellers rise to the challenge of raising their young when stretched to their physiological limits? Cayleigh Robertson and Grant McClelland from McMaster University, Canada, investigated how new mums from low- and high-altitude deer mouse populations managed when raising a litter in the warm (24°C) low altitudes with

normal oxygen levels, followed by a second litter in cold (5°C) simulated mountain air with less oxygen.

Monitoring the mums and their young for 21 days until the pups were ready to leave the nest, the researchers showed that low-altitude nursing mothers raising their young in cold thin air were firing on all cylinders, running at 85% of their maximum metabolic performance. In contrast, the mothers that originated at ~4300 m on Mount Evans, CO, USA, only ran their engines at 70% of their peak metabolic output in the cold mountain conditions; they were better prepared for the privations of mountain life.

Meanwhile, the low-altitude mums worked really hard to raise their litters in the cold thin air – increasing the amount

of time spent nursing, as well as producing richer milk – even though their litters were smaller (2–6 pups) than the litters of high-altitude mothers (2–10 pups). Yet, despite having fewer offspring to care for, the low-altitude mothers' young failed to thrive in the thin mountain air; they were 35% smaller than their siblings that grew up in warm low-altitude conditions. In contrast, the high-altitude mothers only made a little additional effort to raise their pups on the simulated mountain peak and had less milk to go around their larger litters; nonetheless, they successfully reared healthy full-weight pups that grew into robust adults.

'These data suggest that high-altitude mothers prioritise their own maintenance costs over investing heavily in their offspring', says Robertson, who suspects that the metabolic rate of the offspring produced by high-altitude mothers is lower than that of pups born to low-altitude parents to compensate for their mothers' dereliction, possibly delaying their ability to generate their own warmth. The duo also suggests that the ability of deer mice to balance their own needs against those of the next generation could have been the key that allowed them to move up in the world and colonise mountain peaks.

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