

## INSIDE JEB

## Glucose breakfast kickstarts grizzlies out of hibernation



A grizzly bear being fed a glucose drink in summer at the Washington State University Bear Research, Education and Conservation Center, USA. Photo credit: Brandon Hutzenbiler.

As most creatures settle down for a doze, their metabolic rates dip a little, but when a grizzly bear embarks on its lengthy annual slumber, the massive mammals drop their metabolic rate by a mind-boggling 75%. Prior to their lengthy nap, bears go on a binge as the days shorten and food grows scarce, piling on the pounds to sustain them. However, some grizzlies that reside in Alaska with a plentiful year-round supply of salmon don't bother bedding down through winter. Intrigued by the Alaskan bears' resilience, Heiko Jansen from Washington State University, USA, wondered if it might be possible to pull hibernating bears out of their slumber simply by feeding them.

Fortunately for Jansen, Joanna Kelley and Charlie Robbins (both from Washington State University), hibernating grizzlies aren't out cold during the entire hibernation season. The bears awaken briefly each day to get up and adjust their bedding, so the team knew they would be able to feed the animals hibernating at the Washington State University Bear

Research, Education and Conservation Center each time they arose over a 10 day period. However, instead of feeding the grizzlies a diet packed with energy and protein, the team decided to focus simply on supplementing 57% or 100% of the energy that the animals require to survive hibernation. 'Bears have a sweet tooth – think Winnie the Pooh', Jansen chuckles, explaining that Robbins and colleagues had already trained the animals to enjoy bottles of dilute honey squirted into their mouths while the scientists surreptitiously took blood samples; 'feeding glucose was an easy transition', Jansen says. Then, the team collected blood samples from the bears to measure their blood sugar and monitored the animals' activity levels over the following 2 months.

Impressively, the bears more than doubled their activity levels in the days following their 10 day breakfast, but most surprisingly, they were still feeling the beneficial effects – remaining active – almost 2 months later; they were coming out of hibernation. And, when

Michael Saxton, Hannah Hapner and Madeline McPhee measured how much sugar was in the bears' blood 2 h after their energy drink, the size of the glucose spike reduced a little over the 10 day period. Jansen explains that hibernating bears are essentially diabetic; they are unable to absorb sugar released into their blood, just like diabetic humans, hence the spike in blood sugar after consuming glucose. So, although the fed bears weren't able to absorb all of the sugar from their blood, they were able to reduce it; their mid-hibernation glucose snacks were reducing their diabetes-like condition.

In addition, Anthony Carnahan found that the fed bears' metabolism was running faster than the metabolism of fully hibernating bears – their hearts were beating twice as fast ( $\sim 20$  beats  $\text{min}^{-1}$ ). 'These changes did not approach active season level, but they were persistent', says Jansen. And when Brandon Hutzenbiler measured the metabolic rate of fat cells collected from the hibernating bears before and after they were fed, the metabolism of the fed bears was running 33% faster than that of the fully hibernating bears; the glucose supplement had boosted their metabolism.

Feeding energy to bears, in the form of glucose, during hibernation does bring them partially out of their seasonal slumber and now Jansen and Kelley are keen to add carbohydrates, fats and protein to the dormant grizzlies' diet, to find out whether a full menu can completely revive the animals at the time of year when they should snooze round the clock.

10.1242/jeb.242927

Jansen, H. T., Hutzenbiler, B. E., Hapner, H. R., McPhee, M. L., Carnahan, A. M., Kelley, J. L., Saxton, M. W. and Robbins, C. T. (2021). Can offsetting the energetic cost of hibernation restore an active season phenotype in grizzly bears (*Ursus arctos horribilis*)? *J. Exp. Biol.* **224**, jeb242560. doi:10.1242/jeb.242560

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