

# Summertime cholesterol consumption key for wintertime survival for Siberian hamsters

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A study published in a forthcoming issue of *Physiological and Biochemical Zoology* shows that in order to enter daily torpor during winter, Siberian hamsters must eat a summertime diet that contains cholesterol. Credit: Małgorzata Jefimow

Increasingly, scientific findings indicate that an organism's diet affects more than just general health and body condition. In an article published

in a forthcoming issue of the journal *Physiological and Biochemical Zoology*, researchers from Nicolaus Copernicus University have found evidence that the diet of some animals must include cholesterol in order for them to enter necessary periods of energy conservation known as torpor.

Torpor is a temporary, strategic decrease of body temperature and metabolic, heart, and respiration rates that can enable an organism to survive periods of low ambient temperatures and limited food resources. "Daily torpor" describes short periods of torpor that occur on a daily basis; when torpor occurs on a seasonal basis, it is known as "hibernation."

The ability of heterothermic animals to enter daily or seasonal torpor depends on the presence of various nutrients. For example, before winter, hibernating rodents seek out foods rich in polyunsaturated fatty acids (PUFAs). PUFAs are vital to proper cell function: with their lower melting points, PUFAs allow cell membranes to remain fluid at low temperatures, ensuring that they work correctly even at low body temperatures. Cholesterol is another nutrient known to influence torpor. Similar to PUFAs, it stabilizes cell membranes; additionally, cholesterol may modify the activity of [cell-membrane](#) proteins. Cholesterol is synthesized endogenously (mainly in the liver), but it is also absorbed from the diet when present (e.g., from invertebrates).

In the *PBZ* article, Jefimow et al. predicted that increases in [dietary cholesterol](#) during summer results in higher cholesterol content in brain tissues—and thus, enhanced daily torpor—during winter. They tested this hypothesis in a series of laboratory experiments involving Siberian hamsters (*Phodopus sungorus*). These small, heterothermic rodents employ wintertime daily torpor; a typical source of dietary cholesterol for Siberian hamsters is insect larvae, which generally consist of 0.1%-0.3% cholesterol.

Hamsters in the study were first acclimated to summerlike conditions and fed diets consisting of 0%, 0.3%, 1.0%, or 2.5% cholesterol. Then, they were exposed to winterlike conditions (reduced ambient temperatures and shorter days). Individuals who had consumed a diet containing any amount of cholesterol during summer entered daily torpor in winter, whereas those that consumed no cholesterol in summer did not. The presence of cholesterol in the summer diet increased the wintertime cholesterol levels in the brains of hamsters during the winter daily torpor period but not during the summer. These findings indicate that first, cholesterol intake during summer alone is sufficient to enhance daily torpor during the winter, and second, the minimum amount of dietary cholesterol necessary for Siberian hamsters to undergo winter daily torpor is not more than 0.3%—the amount found in insect larvae.

This is the first study to demonstrate the effects of exogenous dietary cholesterol on mammalian daily torpor. According to the findings, for Siberian hamsters, eating a diet that contains [cholesterol](#) is a healthy choice.

**More information:** M. Jefimow, M. Ostrowski, A. Jakubowska, and M. Wojciechowski, "The Effects of Dietary Cholesterol on Metabolism and Daily Torpor Patterns in Siberian Hamsters," *Physiological and Biochemical Zoology* 87(4), July/August 2014.

[www.jstor.org/stable/10.1086/676319](http://www.jstor.org/stable/10.1086/676319)

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