

Primates: Now with only half the calories

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Male silverback Gorilla in SF zoo. Image: Wikipedia.

New research shows that humans and other primates burn 50% fewer calories each day than other mammals. The study, published January 13 in the *Proceedings of the National Academy of Sciences*, suggests that these remarkably slow metabolisms explain why humans and other primates grow up so slowly and live such long lives. The study also reports that primates in zoos expend as much energy as those in the wild, suggesting that physical activity may have less of an impact on daily energy expenditure than is often thought.

Most mammals, like the family dog or pet hamster, live a fast-paced life, reaching adulthood in a matter of months, reproducing prodigiously (if we let them), and dying in their teens if not well before. By comparison,

humans and our primate relatives (apes, monkeys, tarsiers, lorises, and lemurs) have long childhoods, reproduce infrequently, and live exceptionally long lives. Primates' slow pace of life has long puzzled biologists because the mechanisms underlying it were unknown.

An international team of scientists working with [primates](#) in zoos, sanctuaries, and in the wild examined daily [energy expenditure](#) in 17 primate species, from gorillas to mouse lemurs, to test whether primates' slow pace of life results from a slow metabolism. Using a safe and non-invasive technique known as "doubly labeled water," which tracks the body's production of carbon dioxide, the researchers measured the number of calories that primates burned over a 10 day period. Combining these measurements with similar data from other studies, the team compared daily energy expenditure among primates to that of other mammals.

"The results were a real surprise," said Herman Pontzer, an anthropologist at Hunter College in New York and the lead author of the study. "Humans, chimpanzees, baboons, and other primates expend only half the calories we'd expect for a mammal. To put that in perspective, a [human](#) – even someone with a very physically active lifestyle – would need to run a marathon each day just to approach the average daily energy expenditure of a mammal their size."

This dramatic reduction in metabolic rate, previously unknown for primates, accounts for their slow pace of life. All organisms need energy to grow and reproduce, and energy expenditure can also contribute to aging. The slow rates of growth, reproduction, and aging among primates match their slow rate of energy expenditure, indicating that evolution has acted on metabolic rate to shape primates' distinctly slow lives.

"The environmental conditions favoring reduced energy expenditures may hold a key to understanding why primates, including humans,

evolved this slower pace of life," said David Raichlen, an anthropologist at the University of Arizona and a coauthor of the study.

Perhaps just as surprising, the team's measurements show that primates in captivity expend as many calories each day as their wild counterparts. These results speak to the health and well-being of primates in world-class zoos and sanctuaries, and they also suggest that physical activity may contribute less to total energy expenditure than is often thought.

"The completion of this non-invasive study of primate metabolism in zoos and sanctuaries demonstrates the depth of research potential for these settings. It also sheds light on the fact that zoo-housed primates are relatively active, with the same daily energy expenditures as wild primates," said coauthor Steve Ross, Director of the Lester E. Fisher Center for the Study and Conservation of Apes at Chicago's Lincoln Park Zoo. "Dynamic accredited zoo and sanctuary environments represent an alternative to traditional laboratory-based investigations and emphasize the importance of studying animals in more naturalistic conditions."

Results from this study hold intriguing implications for understanding health and longevity in humans. Linking the rate of growth, reproduction, and aging to daily energy expenditure may shed light on the processes by which our bodies develop and age. And unraveling the surprisingly complex relationship between physical activity and daily energy expenditure may improve our understanding of obesity and other metabolic diseases.

More detailed study of energy expenditure, activity, and aging among humans and apes is already underway. "Humans live longer than other apes, and tend to carry more body fat," said Pontzer. "Understanding how human metabolism compares to our closest relatives will help us understand how our bodies evolved, and how to keep them healthy."

More information: Primate energy expenditure and life history,
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Provided by Lincoln Park Zoo

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