Humans have faster metabolism than closely related primates, enabling larger brains

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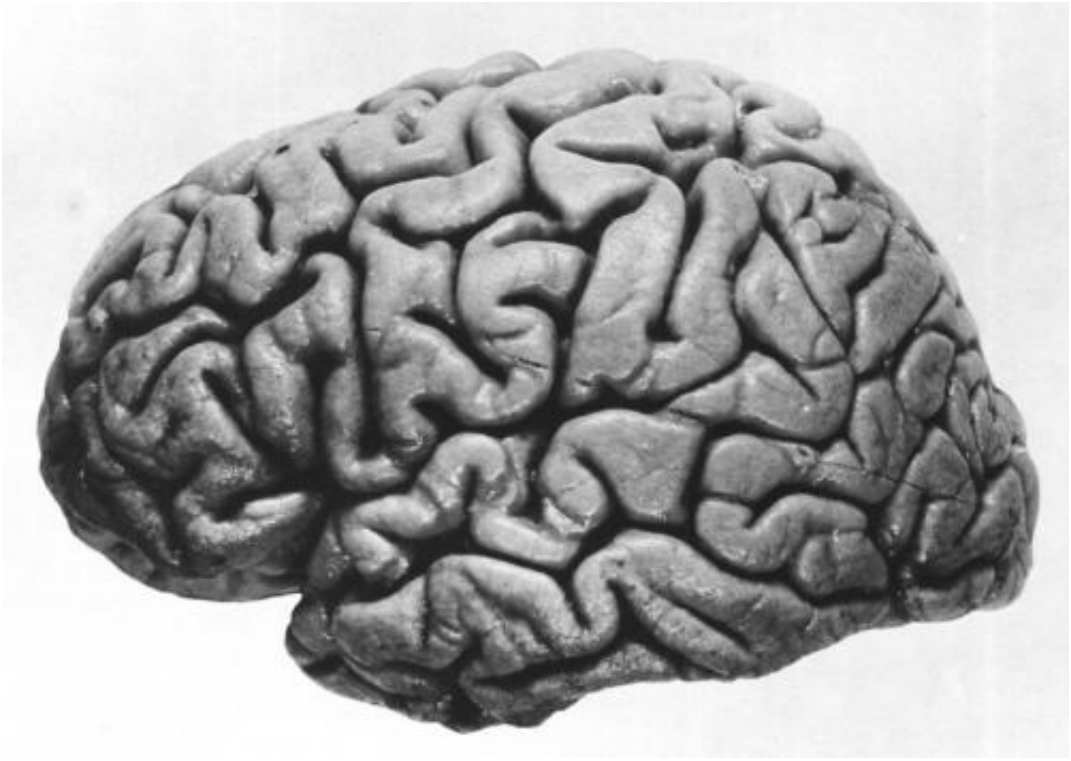

Left hemisphere of J. Piłsudski's brain, lateral view. Credit: public domain

Loyola University Chicago researchers are among the co-authors of a groundbreaking study that found humans have a higher metabolism rate than closely related primates, which enabled humans to evolve larger brains.

The study, published in the journal *Nature*, found that humans also have a higher percentage of body fat, providing the energy reserves to fuel their faster metabolism. The findings may point toward strategies for combating obesity, researchers said.

The study found that, adjusted for body size, on a daily basis humans consume 400 more calories than chimpanzees and bonobos (closely related to chimps), 635 more calories than gorillas and 820 more calories than orangutans.

Co-authors of the study include Amy Luke, PhD, Lara R. Dugas, PhD, and Ramon Durazo-Arvizu, PhD, of the Department of Public Health Sciences of Loyola University Chicago Stritch School of Medicine and Graduate School. First author is Herman Pontzer, PhD, of Hunter College in New York.

The study confirmed the researchers' hypothesis that humans evolved a faster metabolism and larger energy budget to accommodate larger brains, which consume more calories. The higher metabolism also supports having more offspring and a longer lifespan.

In the study, researchers used an objective technique to measure total energy expenditure in humans and great apes. Total energy expenditure includes calories burned by the body's metabolism at rest, plus calories burned during physical activity. (The technique researchers used to measure energy expenditure is called the doubly labelled water method.) Total energy expenditure was measured over seven to 10 days while the apes and humans followed their normal routines. The study included 141 humans and 56 zoo animals: 27 chimpanzees, eight bonobos, 10 gorillas, and 11 orangutans.

The study found that the percentage of body fat was markedly higher in humans, and only humans showed a significant gender difference - 22.9

percent body fat in men, 41.7 percent body fat in women.

The human data were derived from a separate study, headed by Luke, called the Modeling the Epidemiological Transition Study (METS). Luke and colleagues are seeking to understand the relationship between physical activity and energy expenditure and weight gain in adults. The METS study includes adults from the United States, South Africa, Ghana, Seychelles and Jamaica.

Humans and great apes together form a superfamily called hominoids. Metabolic measurements of hominoids may point to ways to fight obesity and metabolic diseases such as diabetes and heart disease.

"Humans exhibit an evolved predisposition to deposit fat whereas other hominoids remain relatively lean, even in captivity where activity levels are modest," researchers wrote. "Untangling the evolutionary pressures and physiological mechanisms shaping the diversity of metabolic strategies among living hominoids may aid efforts to promote and repair metabolic health for humans in industrialized populations and apes in captivity."

More information: Herman Pontzer et al, Metabolic acceleration and the evolution of human brain size and life history, *Nature* (2016). DOI: 10.1038/nature17654

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