No bones about it: Wild gorillas don't develop osteoporosis like their human cousins

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Photo of adult female Virunga mountain gorilla with baby. Inset shows bone mineral scans of third lumbar vertebrae of young (19.9 years, top image) and old (38.3 years, bottom image) female gorillas. A Johns Hopkins Medicine study shows that unlike human females, the bone mineral density in these animals does not decline with age. Credit: Gorilla photo: Jordi Galbany and Dian Fossey Gorilla Fund; bone scans: Johns Hopkins Center for Functional Anatomy and Evolution

In a study of gorilla skeletons collected in the wild, Johns Hopkins Medicine researchers and their international collaborators report that aging female gorillas do not experience the accelerated bone loss associated with the bone-weakening condition called osteoporosis, as their human counterparts often do. The findings, they say, could offer clues as to how humans evolved with age-related diseases.

The study was published on Sept. 21, 2020, in *Philosophical Translations of the Royal Society B*.

"Osteoporosis in humans is a really interesting mechanical problem," says Christopher Ruff, Ph.D., professor at the Center for Functional Anatomy and Evolution at the Johns Hopkins University School of Medicine. "In terms of natural selection, there is no evolutionary advantage in developing bone loss with aging to the point of a potential fracture. By looking at close relatives of humans on the evolutionary tree, we can infer more about the origins of this condition."

The Johns Hopkins research team worked with the Rwanda Development Board, Gorilla Doctors, the Dian Fossey Gorilla Fund International and George Washington University researchers to study the bone collection of mountain gorillas from Rwanda's Volcanoes National Park. The park is one of the few places in the world where conservationists can observe wild gorillas throughout their lifetimes. After a gorilla dies in the wild, its bones are carefully gathered, cataloged and added to the collection housed at the Fossey Fund's Karisoke Research Center.

"This detailed, long-term data on individual gorillas is critically important to this kind of anatomical research work," says Ruff. "Extensive demographic information, including the age at death, allows investigations that are difficult or impossible to carry out in other wild primate populations."

Ruff and his colleagues were able to analyze the bones of 34 wild mountain gorillas—16 females and 17 males, ages 11 to 43 years. This spans the full adult range of the species. Using a specialized CT scanner brought to Rwanda, the researchers examined the leg, arm and spine bones from each animal (including the femur, tibia, radius, ulna, humerus and lumbar vertebrae), taking measurements of bone density and geometry.

The researchers found some features of skeletal aging among the gorillas that are similar to those observed in humans, including a general widening of the diameter of long bones and thinning of the bone wall. However, the gorilla bones did not show any of the accelerated bone mineral loss associated with age-related osteoporosis in human skeletons. In humans, women tend to lose bone mineral density more than men. However, in the mountain gorillas, there was no significant difference in bone density or overall strength between older males and females.

These differences, Ruff says, may be explained by the fact that gorillas continue to have offspring throughout their lives, maintaining hormonal levels that help protect them from bone loss. Higher activity levels also may help grow and then maintain stronger bones.

Based on their study results, Ruff and his colleagues hypothesize that this new life stage in humans emerged after the evolutionary split between humans and African apes, and that it could be when some of our age-related diseases, including osteoporosis, originated.

More information: Christopher B. Ruff et al. Skeletal aging in Virunga mountain gorillas, *Philosophical Transactions of the Royal Society B: Biological Sciences* (2020). DOI: 10.1098/rstb.2019.0606

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