T. rex bite 'no match for a finch'

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Credit: University of Reading

Tyrannosaurus rex, renowned for being one of the most fearsome creatures to have ever lived, evolved a bite that was less impressive in relation to its body size than a tiny Galapagos ground finch, scientists say.

New analysis by scientists at the University of Reading and the University of Lincoln has shown the evolution of T. rex was not led by a strong need for a bone-crushing bite to kill its prey. Instead, it had a bite force (57,000 Newtons) that was completely average for its body mass (8 tonnes) and which evolved gradually over tens of millions of years.

Comparatively, a Galapagos large ground finch was found to have the most powerful bite in relation to its body size of all the animals in the

study, packing an impressive 70N of force, despite weighing just 33 grammes. This makes the bite force of the finch about 320 times more powerful, pound-for-pound, than T. rex. Moreover, the finch evolved its mega-bite relatively quickly, in less than one million years.

The research also suggests human intelligence may have led to us having an extremely weak bite. This is owing to the evolution of our larger brains taking up space in our heads where the muscles critical for hard biting would otherwise be.

Dr. Manabu Sakamoto, biological scientist at the University of Reading and lead author of the study, said: "The image of T. rex with its fierce jaws has helped it become the most iconic of dinosaurs, but our research shows its bite was relatively unremarkable. Bite force was not what gave T. rex its evolutionary advantage, as was previously presumed.

"Large predators like T. rex could generate enough bite force to kill its prey and crush bone just by being large, not because they had a disproportionately powerful bite. This counters the idea that an exceptionally strong need for a powerful bite drove these ancient beasts to evolve bone-crushing bite forces."

Dr. Chris Venditti, University of Reading, co-author on the study, said: "Our research provides new insight into the latest theories about the speed and drivers of evolution. It also allows us to create some fascinating hypothetical match-ups.

"The proclaimed 'King of the Dinosaurs' would be no match for a finch in a fight, if they were the same size."

The authors argue that the study, published in the Royal Society journal *Proceedings B*, shows the course of evolutionary history should not be ignored when looking at how animals developed distinctive traits.

The scientists used supercomputers to analyse the largest ever collection of bite force data from 434 species both extinct and surviving, including reptiles, birds and mammals. They investigated the theory that animals with more powerful bites were forced to rapidly evolve that way owing to changes to their diets.

They instead found that the bite power of most of these animals developed proportionally to evolutionary changes to their body size over time, with only some seeing their bite forces develop at a faster rate than other changes.

Accelerated bursts of bite power evolution were seen in some animals, especially finches – a species famously first noted as an example of natural selection by Charles Darwin. However, expected increases along with body size during the passage of time was seen to be the most common driver of this trait.

The team even observed more dramatic reductions in bite forces during evolution than increases. This was true for early humans, whose bite power decreased rapidly despite their body size increasing over time.

Dr. Sakamoto said: "An evolutionary trade-off with increasing brain size in humans may be the reason that our bite power is pretty pathetic.

"Once we learnt to cook food, bite power became even less important. In effect, we evolved the cooking pot as our way of making our food easier to swallow. This is in line with other studies showing that humans chew their food less than other animals."

More information: Manabu Sakamoto et al. Extreme and rapid bursts of functional adaptations shape bite force in amniotes, *Proceedings of the Royal Society B: Biological Sciences* (2019). DOI: 10.1098/rspb.2018.1932

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