

**ENERGY EXPENDITURE AND GAIN FROM NUT-CRACKING IN WILD CAPUCHIN MONKEYS (*CEBUS LIBIDINOSUS*) IN PIAUI, BRAZIL**

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Wild bearded capuchin monkeys use large stones to crack palm nuts. The benefits of nut-cracking are unclear, especially since the activity appears energetically costly and exposes the monkeys to increased risk of predation. We determined whether the energy expended to crack a piaçava nut (*Orbignya*), the toughest nut the monkeys crack, exceeds the caloric value of the nut. From video, we coded nut-cracking behavior in two individuals (one adult male and one adult female) during 12 nut-cracking episodes. These individuals used a 1.42kg stone to crack nuts and struck a nut  $3.4 \pm 2.4$  times per nut-cracking episode. We obtained maximum downward velocity of the stone to calculate the maximum kinetic energy (work output) produced by the monkeys. We adopted a range between 5% and 35% of Mechanical Efficiency (ME), which represents how much of the energy expended is actually transferred to the nut. Then we used the work output and the ME to estimate energy expended and compared it to the energetic value of an average nut (162 KJ). Our findings suggest that even with a 5% ME, the monkeys gained a significant amount of energy from nut-cracking. In order to exceed the caloric value of the nut, the monkeys would have to perform more than 549 strikes on one nut (whereas the maximum we observed was 8 strikes for one nut). We conclude that nut-cracking is well worth the monkeys' efforts, energetically, even if they are only intermittently successful at opening a nut (as is the case for smaller monkeys).

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