Wild monkeys shown to give birth during optimal body and environmental temperatures

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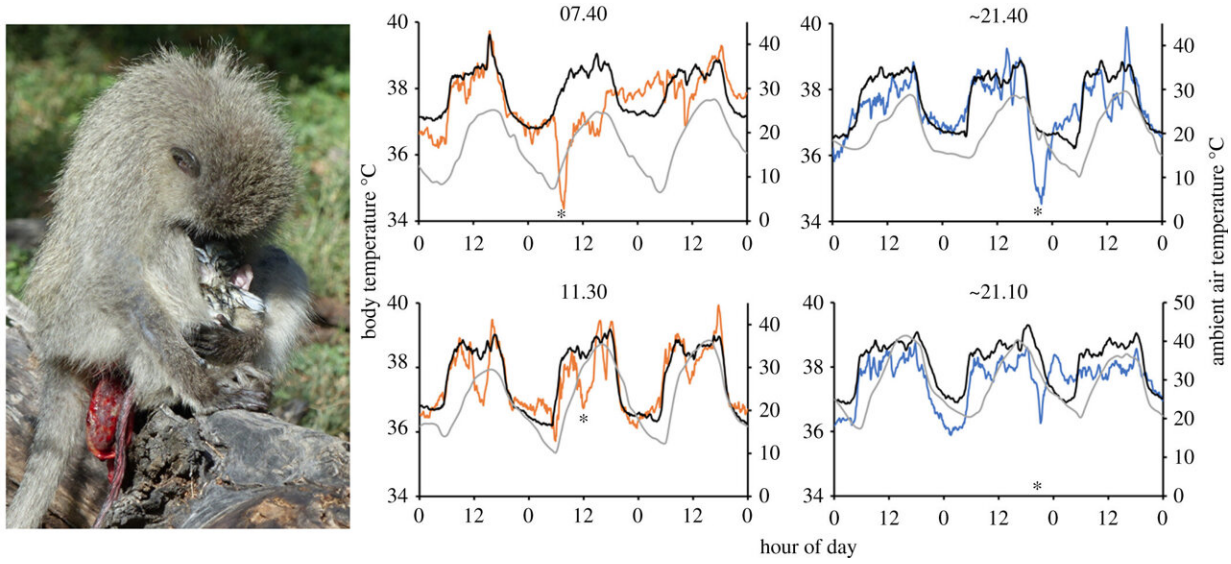

Figure 1. Maternal 72 h body temperature (T_b) rhythms across two diurnal (orange lines) and two nocturnal (blue lines) vervet monkey births. Asterisks denote time of birth. Black lines denote the average non-birthing female time-matched 72 h T_b, and grey lines denote ambient air temperature. Top-left birth was photographed and video recorded (electronic supplementary material, Video). Credit: DOI: 10.1152/ajpendo.00260.2021

As part of a long-term study of wild vervet monkeys using state of the art bio-logging technology, research led by Nottingham Trent University

has for the first time recorded the birth temperatures of wild primates.

The research tests traditional ideas of why monkeys who are active during the day have evolved to give birth at night. Nocturnal birth has long been seen as a strategy for predator avoidance or as a means for mothers to recover from birth and bond with the infant without interference by other monkeys or troop movements.

Over the course of seven years, 17 births which took place during an inactive night-time phase were analyzed. Two daytime births were also witnessed and examined.

Birthing females were seen to experience lower night-time core body temperatures than non-birthing females and reached those temperatures earlier in the night. Birthing females also experienced lower temperatures during birth than they did during the night seven days prior.

For the two daytime births, researchers identified a drop in maternal body temperature before giving birth, immediately followed by a swift rise.

Dr. Richard McFarland, senior lecturer in Psychology at NTU's School of Social Sciences, has spent almost ten years studying the thermoregulation of primates in South Africa, including the impact of climate on their behavior. He said: "Our findings suggest that there may be important thermal consequences linked to the timing of primate birth.

"We observed that a mother's body temperature lowers at birth to create a cooler thermal environment that serves to protect the fetus from injury during hypoxic birth conditions. Immediately after birth is also a critical period for the infant, where the new-born can be at risk of hypothermia if they are born on a cold night, or at risk of hyperthermia if they are

born during the heat of the day. The mother's own physiology, and behavior toward the infant, is essential during this period.

"Giving birth at night maximizes the thermal efficiency of the birth process, making it easier for the mother to lower her body temperature at birth, in conditions that tend to be cooler. It would be physiologically more challenging to give birth during the heat of the day, when the mother's body temperature is naturally higher.

"In addition, during the night the mother doesn't need to implement evaporative cooling to lower her temperature and can instead rely on less costly dry heat loss. At a time when maternal resources are at a premium, any means by which resources can be conserved, and physiological processes made less costly, are likely to improve the welfare of both mother and infant."

Vervet monkeys are also known consume the placenta after birth, which has previously been argued to replenish nutritional losses from pregnancy, reduce pain and prevent the placenta from attracting predators. The researchers now suggest that it may also provide the energy needed to recover temperature post-birth.

The findings of the study have wide-reaching implications both for the understanding of primate reproduction and human birth patterns and health risks.

Dr. McFarland added: "It seems reasonable to suggest that the timing of birth will be particularly important for smaller, more thermally-vulnerable species, where birth should be more synchronized to the most thermally advantageous time. This may explain why apes are less committed to night-time birth than monkeys.

"Humans, like monkeys, tend to give birth more frequently at night, but

not as routinely as other non-human primates. Greater flexibility in the timing of human births is likely a consequence of our reliance on medical intervention, including the typically cool artificial environments of birth places and a greater reliance on hospital births and medical intervention. Nonetheless, the risk of neonatal hypothermia, in particular, remains a significant cause of infant morbidity and mortality, especially in developing countries and during winter months."

The paper The thermal consequences of primate birth hour and its evolutionary implications has been published in the Royal Society journal *Biology Letters*.

More information: Richard McFarland et al, The thermal consequences of primate birth hour and its evolutionary implications, *Biology Letters* (2022). DOI: 10.1098/rsbl.2021.0574

Provided by Nottingham Trent University