The Auk 114(1):133, 1997

Is the Energy Cost of Begging by Nestling Passerines Surprisingly Low?

WESLEY W. WEATHERS,[1] PETER J. HODUM, AND DAVID J. ANDERSON[2]
Department of Avian Sciences, University of California, Davis, California 95616, USA

McCarty (1996) reported that oxygen consumption rates ($\dot{V}O_2$) of resting and begging nestlings of five passerine species were little different and often equivalent. From this he concluded that begging is not a costly trait. In 1990, we obtained a similar result (Weathers and Anderson unpubl. data) with nestling Zebra Finches (*Taeniopygia guttata*) using a more sensitive $\dot{V}O_2$ method than McCarty's. We placed nestling Zebra Finches in a small-volume respirometer (350 mL) and employed open circuit respirometry coupled with the "instantaneous" method to determine $\dot{V}O_2$ (Bartholomew et al. 1981). Despite finding negligible differences between the $\dot{V}O_2$ of begging and resting nestlings (less than a 5% increase over resting levels; $n = 3$), we were unable to conclude that begging had a low energy cost because we measured only one of the two processes by which animals utilize energy, namely aerobic metabolism. Most or even all of the energy that nestlings use when begging might be provided anaerobically, given the limited metabolic scope of altricial neonates (Weathers 1996).

In anaerobic metabolism, which often is used to support short-duration, burst activities, ATP production does not involve oxygen consumption and results in the formation of lactic acid rather than water and carbon dioxide as in aerobic metabolism (see Bartholomew 1977). When engaging in anaerobic metabolism, animals incur an "oxygen debt" that is repaid after the activity ceases by metabolizing the lactate aerobically. Consequently, energy utilization and oxygen consumption are uncoupled temporally in anaerobic metabolism. Repaying the oxygen debt results in an increase in $\dot{V}O_2$ that is proportional to the amount of lactate formed. The increase in $\dot{V}O_2$ that occurs during debt repayment is easy to overlook unless large amounts of lactic acid are formed, and it is likely that the increase would not have been detected with McCarty's experimental protocol.

Begging may have little energy cost, as McCarty (1996) suggests. Alternatively, the costs could be much higher than he reports if the energy is supplied anaerobically. Testing this hypothesis would require measuring the concentration of lactic acid in nestlings before and after bouts of begging. Given the small size of many nestlings, this might require determining whole-body lactate concentrations, not just blood lactate levels. Until the proper experiments are performed, it is premature to conclude that begging has little energy cost.

LITERATURE CITED

BARTHOLOMEW, G. A. 1977. Energy metabolism. Pages 57–110 *in* Animal physiology: Principles and adaptations, 3rd ed. (M. S. Gordon, Ed.). Macmillan, New York.

BARTHOLOMEW, G. A., D. VLECK, AND C. M. VLECK. 1981. Instantaneous measurements of oxygen consumption during pre-flight warm-up and post-flight cooling in sphingid and saturnid moths. Journal of Experimental Biology 90:17–32.

MCCARTY, J. P. 1996. The energetic cost of begging in nestling passerines. Auk 113:178–188.

WEATHERS, W. W. 1996. Energetics of postnatal growth. Pages 461–496 *in* Avian energetics and nutritional ecology (C. Carey, Ed.). Chapman and Hall, New York.

[1] E-mail: wwweathers@ucdavis.edu

[2] Present address: Department of Biology, Wake Forest University, Winston-Salem, North Carolina 27109, USA.

Received 19 April 1996, accepted 9 July 1996.
Associate Editor: D. L. Kilgore