

Water balance of free-ranging little brown bats (*Myotis lucifugus*) during pregnancy and lactation

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This study provides the first measurements of daily water flux in free-ranging bats during pregnancy and lactation. We used the wash-out rate of tritiated water from the body water pool to calculate daily water flux in 10 pregnant and 14 lactating little brown bats (*Myotis lucifugus*). Average water influx was 6.16 ± 0.47 (SE) mL/day during pregnancy and 6.91 ± 0.37 mL/day during lactation; average efflux was 6.27 ± 0.44 and 7.07 ± 0.36 mL/day during pregnancy and lactation, respectively. Using data from the literature, we partitioned daily flux into major components. Our calculations indicated that most (>62%) water influx was preformed water in the insect diet. Drinking water represented 23–26% of daily influx. Although previous studies indicated that evaporative losses greatly exceeded urinary losses in laboratory-maintained *M. lucifugus*, urinary and evaporative losses were comparable in our free-ranging bats. Urinary losses represented 46% of water efflux during pregnancy and 35% during lactation. Over 80% of all water efflux occurs during the 8-h night.

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On trouvera ici les résultats d'une étude originale sur le flux hydrique quotidien de chauves-souris au cours de la grossesse et de la lactation. Nous avons utilisé le taux d'élimination d'eau tritiée à partir du pool hydrique total chez 10 femelles enceintes et 14 femelles nourricières du Vespertilion brun (*Myotis lucifugus*) pour calculer le flux hydrique quotidien. L'influx hydrique moyen a été évalué à $6,16 \pm 0,47$ mL/jour (erreur type) au cours de la grossesse et à $6,91 \pm 0,37$ mL/jour au cours de la lactation; l'élimination moyenne est de $6,27 \pm 0,44$ chez les femelles enceintes et de $7,07 \pm 0,36$ mL/jour chez les femelles nourricières. Nous avons déterminé les principales composantes du flux quotidien à partir des données de la littérature : nos calculs indiquent que la plus grande partie (>62%) de l'influx hydrique provient d'eau déjà présente dans les insectes consommés. L'eau bue représente 23–26% de l'influx quotidien. Bien que des études antérieures aient indiqué que les pertes d'eau par évaporation semblent excéder considérablement les pertes d'eau dans l'urine chez des *M. lucifugus* gardés en laboratoire, les résultats de notre étude indiquent que les pertes d'eau dans l'urine sont comparables aux pertes d'eau par évaporation chez les chauves-souris libres. Les pertes d'eau dans l'urine constituent 46% de l'élimination pendant la grossesse et 35% durant la lactation. Plus de 80% de toute l'élimination d'eau se produit durant les 8 h de la nuit.

[Traduit par la revue]

Introduction

The water economy of mammals has been examined in a number of species, with emphasis on compartmentalization of water loss and the adaptive role of kidney structure (e.g., Chew 1965; MacMillen 1972; Geluso 1978). Such studies provide valuable insight toward understanding water relations in mammals, particularly desert forms, but most measurements have been on animals confined to the laboratory. Water flux, however, is generally correlated with metabolic rate (Macfarlane and Howard 1972), and the metabolic rate of free-ranging mammals is generally greater than that of animals in captivity (Nagy 1987). In addition, laboratory conditions (temperature, humidity, diet, etc.) are frequently quite different from those that an animal experiences in the wild. Consequently, a thorough understanding of mammalian water balance requires the quantification of water flux under field conditions.

Bats are particularly intriguing mammals in which to investigate water flux, for a number of reasons. Their small size, large naked flight membranes, and warm roosts presumably lead to high rates of evaporative water loss at rest (Bassett 1980). In flight, water loss is even greater (Carpenter 1986). Moreover, many bats depend on high-protein diets, such as insects, and consequently face high urea loads. Although bats are the second largest group of mammals, only two previous studies (Helvesen and Reyer 1984; Bell et al. 1986) have quantified water flux of bats in the field, and both studies used only nonreproductive individuals. In the present paper we provide the first measurements of daily water influx and efflux in free-ranging bats during pregnancy and lactation.

Myotis lucifugus is a small (7–11 g) insectivorous bat which is widely distributed across North America (Barbour and Davis 1969). Kurta et al. (1989) recently reported field measurements of metabolic rate for *M. lucifugus*, made with the doubly labeled water technique. This method uses the differential turnover of hydrogen and oxygen isotopes in the body water pool to calculate carbon dioxide production (Nagy 1980). The doubly labeled water technique also allows the separate calculation of water influx and efflux, using the wash-out rate

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