

NEST SANITATION: A POSSIBLE FACTOR IN THE WATER ECONOMY OF THE ROADRUNNER

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The urine and feces voided by most altricial nestlings are enclosed in mucus sacs. The contents do not foul the nest, but are usually dropped by the parents while flying away from the nest. Some species ingest the wastes from their young. This reprocessing may represent a digestive economy similar to re-ingesting of feces by the lagomorphs (Welty 1962).

A pair of hand-reared adult Roadrunners (*Geococcyx californianus*) bred in a 3 × 6 m outdoor pen and raised a chick to fledging. The following observations were limited to this one chick, but seemed worthy of mention since this kind of information is not available from field studies.

Immediately after feeding a chick, the parent would cock its head to examine the rear of the chick, as if expecting expulsion of wastes. When voided, these were swallowed by the parent.

The waste sacs had assumed impressive volumes (two were more than 5 ml) when the chick was 14 days old. Samples were obtained by aspiration into a graduated 12 mm plastic syringe immediately after the sacs were voided. This involved competition with the attending parent, the instinct for removal of the sacs seeming to be very strong. Samples were transferred to small pyrex centrifuge tubes, stoppered, and frozen. Thawing and centrifugation immediately preceded analysis. The osmolality of the urine supernatant was determined from its freezing point, using a Fiske osmometer (model H).

The mean (\pm SE) concentration of 10 samples was 319 ± 6.5 milliosmolal (see table 1), with no progressive change observed between ages of 14 and 26

days. The adult Roadrunner with food and water freely available can form urine as concentrated as 718 milliosmolal (Calder and Bentley 1967), which is far greater than the maximum value (460 milliosmolal) observed from the chick. Either the ability or the need to form urine as concentrated as that of the parents was not developed in the chick during this period. Similarly, young mammals cannot form urine as concentrated as that of the adults, and this is correlated with development of the kidney (Smith 1951).

On a hot day an adult Roadrunner may lose 105 g of water as respiratory evaporation (estimated from Calder 1966; assumptions: 8 hrs inactive at 25°C, 16 hrs active at 5 x resting level, 8 hr of which at 30°C, 4 hr at 35°C, 2 hr at 40°C, and 2 hr at 45°C). About 30 g of water per day are lost in urine and feces in metabolism cages (Calder, unpublished). The total water requirement might be 135 ml per bird per day.

Would the water salvaged in nest sanitation be a significant economy? The clutch size of the Roadrunner is generally three to five or six eggs, but may reach 12 eggs (Sutton 1940). The parents would reprocess 75 ml of wastes daily from a brood of five chicks in this stage of development, each voiding 5 ml three times daily. By concentrating urine to the mean 453 milliosmolal for adults (Calder and Bentley 1967), only 53 ml of urine would be formed, resulting in a saving of 22 ml of water. Perhaps 0.4 ml of this would be lost as respiratory evaporation associated with the metabolic effort of urine formation, assuming similarity to man in this regard, or 7.04 cal/ml of urine produced (Kleiber 1961). Each adult parent would thus gain over 10 ml of water if the savings were divided equally. This is 7.5 per cent of the total daily requirement. If the adults concentrated the urine to the maximum concentration observed (718 milliosmolal) each would gain 20 ml of water. Thus it appears possible that the ingestion of fecal sacs may serve a dual function for the Roadrunner, including nest sanitation and water conservation.

This work was supported by NIH grant HE-02228.

TABLE 1. Concentrations of urine from a Roadrunner chick.

Sample:	1	2	3	4	5	6	7	8	9	10	Mean
Age (days):	14	15	16	16	17	17	18	19	21	26	
Volume (ml):	5	—	—	5	ca. 3	>2	>2	>3	ca. 7	2	>3.1
Conc. (milliosmolal):	270	329	318	315	276	257	281	357	460	329	319

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Accepted for publication 19 June 1967.