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FEED CONSUMPTION AND FOOD TRANSIT TIME IN NORTHERN RIVER OTTERS (*LUTRA CANADENSIS*)

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Abstract: The amount of feed consumed per day and the rate of food passage were measured in captive male northern river otters (*Lutra canadensis*). Daily feed consumption averaged 33.9 g dry matter/kg body weight. Using ferric oxide as a feed marker, the mean food transit time was determined to be 202 min.
Key words: Otter, *Lutra canadensis,* feed consumption, food transit time.

INTRODUCTION

In the wild, the northern river otter (*Lutra canadensis*) is an opportunistic predator that spends the majority (62%) of its active time hunting and feeding.[13] Its diet has been studied extensively using captive animals[10] and analysis of feces[4,9,13,14,17,20] and gastrointestinal tract contents.[7,8,16,18,19] The typical diet consists primarily of fish but also includes a wide variety of other prey (insects, crustaceans, amphibians, reptiles, birds, and mammals). Published values for feed consumption and the rate of food transit for this species are, however, lacking. Estimates of feed consumption, based on fecal samples or intestinal tract contents obtained in the field, can provide misleading data.[3,8,11] The present study was conducted to obtain accurate information on feed consumption and food transit time in captive river otters fed a known diet.

MATERIALS AND METHODS

Animals

Twelve live-trapped male river otters were obtained from the Bayou Otter Farm (Theriot, Louisiana 70397, USA) on 20 January 1991. Upon arrival at the Michigan State University Experimental Fur Farm, the animals were housed individually outdoors in wire mesh cages (2.44 × 1.22 × 1.22 m) with attached wooden nest boxes (0.91 × 0.61 × 0.51 m). The otters were anesthetized with 130 mg ketamine hydrochloride (Ketaset, Fort Dodge Laboratories, Fort Dodge, Iowa 50501, USA) and 4 mg xylazine (Rompun, Mobay Corp., Animal Health Division, Shawnee, Kansas 66201, USA) administered i.m., weighed, and examined by a veterinarian. They were immunized against mink virus enteritis and botulism and given a booster for canine distemper, adenovirus, parainfluenza, and parvovirus (Vanguard 5, Norden Laboratories, Lincoln, Nebraska 68501, USA). The otters had been vaccinated at the time of capture for canine distemper, adenovirus, parainfluenza, and parvovirus (Galaxy 6 MHP, Solvay Animal Health, Mendota Heights, Minnesota 55120, USA) and rhinotracheitis, calici virus, chlamydia, and panleukopenia (Eclipse 4, Solvay Animal Health). Blood samples were collected (via the jugular vein) for hematologic analysis, and fecal samples were examined for internal parasites.

Feed consumption

The otters were acclimated to the facilities and diet for 26 days prior to the initiation of the feed consumption trial on 19 February 1991. The diet was formulated from ingredients suggested for feeding ranch mink (Table 1).[15] Drinking water was provided ad libitum. During the trial, each animal received a weighed quantity (in excess

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of what it would consume) of the diet b.i.d. for 6 consecutive days. Wasted and uneaten feed was subtracted from the original feed weight. Daily feed consumption for each otter ($n = 11$) was measured, and an average value was calculated. Individual body weights were recorded on the initial and final day of the trial.

Food transit

The rate of food transit was measured for each otter ($n = 12$) on 12 March and 3 April 1991. Each otter was provided the diet described in Table 1 with the addition of ferric oxide (1,000 ppm) as a marker. The time at which each animal first ate the dyed feed was recorded. Each otter was observed at 10-min intervals for the first 30 min and every 5 min thereafter until the dye was observed in the feces. Food transit time was calculated as the interval of time between first ingestion of the dyed feed and the appearance of dye in the feces.

When appropriate, the data were subjected to a one-way analysis of variance. Significant differences ($P < 0.05$) among means were determined by Student's t-test.

Table 1. Composition and nutrient analysis of an otter diet (as-fed basis).

Composition[a]	
Mink cereal[b]	20%
Ocean fish scrap[c]	40%
Poultry byproducts[d]	15%
Beef liver	6.5%
Eggs	3.5%
Water	15%
D-biotin[e]	0.11 mg/kg
Analysis[f]	
Moisture	63.1%
Fat	6.13%
Protein, crude	15.7%
Fiber, crude	1.03%
Total digestible nutrients	32.8%
Calcium	0.97%
Phosphorus	0.61%
Ash	3.95%

[a] The fish, poultry, liver, and eggs were ground through 9.5-mm holes before mixing with the other ingredients.

[b] XK-40 mink cereal, XK Mink Foods, Plymouth, Wisconsin 53073, USA.

[c] Cod, haddock, and flounder; Boston Feed Supply, Natick, Massachusetts 01760, USA.

[d] Tyson Foods, Fort Smith, Arkansas 72901, USA.

[e] United States Biochemical Corp., Cleveland, Ohio 44122, USA.

[f] Litchfield Analytical Services, Litchfield, Michigan 49252, USA.

RESULTS AND DISCUSSION

At physical examination all animals appeared healthy. Microfilaria (*Dirofilaria lutra*) were detected in the blood samples from all animals. Fecal examinations were negative for internal parasites. All otters readily adapted to the cages and the new environment, and all increased in body weight ($\bar{x} \pm$ SEM: 2.32 ± 0.24 kg) during the acclimation period.

Feed consumption

There was no difference ($P > 0.05$) between the mean body weights of otters at the initiation and termination of the 6-day feed consumption trial (9.3 ± 0.38 vs. 9.7 ± 0.47 kg, respectively). During working hours, the otters were casually observed to eat about two to five meals/day. The mean quantity of feed consumed was 853 ± 61.9 g/day (91.8 ± 4.29 g/kg body weight/day) on an "as fed" basis or 315 ± 22.9 g/day (33.9 ± 1.58 g/kg body weight/day) of dry matter; the otters consumed about 9% of their body weight/day of wet feed. The value of 853 g/day is within the food requirement range of about 700–900 g reported for captive otters (species unspecified) fed a prepared diet.[5] It is, however, less than the daily feed consumption of 1.5 and 1.4 kg/day (12.2 and 12.8% of their body weight) reported for male European otters (*L. lutra*) weighing 12.3 and 10.9 kg, respectively.[12] Two approximately 2-mo-old European otter cubs (one male and one female) consumed an average of 15% of their body weight/day over a 14-mo period,[12] and captive European otters "satisfied their hunger" after eating 900–1,000 g of food.[2] Similar quantities of food have been reported in moderately distended stomachs of northern river otters.[19] Because of the potentially greater energy expenditure of otters in the wild, feed intake of captive otters may be less than that of comparably sized animals

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eating a similar diet under the same climatic conditions in the wild.

Although feed consumption was not measured in female river otters in this study, investigations with mink (*Mustela vison*) and European ferrets (*Mustela putorius furo*), other mustelid species in which females are smaller than males, have shown that males consume a greater quantity of feed per day but less feed per unit body weight than do females of the same species.[1] The "high" feed intake of the otter reflects its high metabolic rate, which in mustelids weighing ≥1 kg is approximately 20% greater than expected from the mammalian standard curve, $M = 70W^{0.75}$, relating basal metabolic rate to body weight.[6] In the present study, otters consumed 177 kcal of gross energy/kg body weight/day. This value was comparable to the 140 kcal of metabolizable energy/kg body weight suggested for maintenance of mature ranch mink.[15]

Food transit

The addition of ferric oxide to the diet as a marker to determine the rate of food transit did not adversely affect the palatability of the feed; otters readily consumed the treated diet. The rates of food transit observed for otters during the two trials were not different ($P > 0.05$). The mean food transit time was 202 ± 8.8 min (range, 135–300 min). This time was considerably longer than the approximate 1 hr rate of food transit noted for captive river otters fed crayfish after previously receiving a bland diet.[10] Feeding a diet similar to the one used in the present study, mean food transit times of 186 ± 8.7 and 181 ± 6.5 min were reported for male ranch mink and European ferrets, respectively.[1]

The length of the gastrointestinal tract of the river otter is approximately 4× the distance from the nose to the base of the tail (Aulerich, unpubl. data). This short, straight digestive tract facilitates a rapid rate of food transit but a relatively short period of time for digestion and absorption of nutrients. As in other carnivores, the digestive system of the otter is adapted for digesting protein and fat.

Numerous factors, including age, size, activity, physical condition, environment, diet composition, physical form of the feed, and management procedures, can affect feed intake and food transit times and should be taken into account when making intra- or interspecific comparisons.

CONCLUSIONS

Male northern river otters fed a semisolid coarsely ground diet consisting of fish and poultry by products, liver, eggs, and fortified mink cereal consumed 33.9 g dry matter/kg body weight/day. The amount of wet feed consumed per day was equivalent to about 9% of body weight. The mean food transit time was 202 min, which was slightly longer than that reported for mink and European ferrets.

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