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Food Requirements of the Lesser Bandicoot Rat [1]

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The lesser bandicoot rat *Bandicota bengalensis varius* (Thomas, 1907) found in Rangoon, Burma, frequently attains body weights twice the size of those reported for the same species in Bombay and Calcutta. Food consumption per unit body weight for this larger subspecies exceeds those values previously reported for other subspecies. Food requirements as a percent of body weight range from 16% for a 50 g juvenile to 3.3% for a 700 g obese adult. Young rats require approximately 50 kcal/100 g body weight daily, whereas a 700 g adult needs only 10.5 kcal/100 g to sustain weight. Males gained weight faster than females and converted 20% of daily food consumption into body weight increases while females converted only 17.4% into weight gains.

[Rodent Control Demonstration Unit, P.O. Box 14, Rangoon, Burma].

1. INTRODUCTION

Knowledge of the average amount of food consumed daily by the individual members of a rodent population is important when planning poisoning campaigns or when using baits as a population census method and, in general, gaining an understanding of how much stored or waste foods are required to support a population in a given area. Such values often are used to predict the extent of economic damage and losses due to a particular rodent species.

Laboratory studies of food consumption by the lesser bandicoot rat, *Bandicota bengalensis*, have been made by a number of investigators in several parts of India (Chitre & Deoras, 1966; Pingale *et al.*, 1967; Spillett, 1968; Parrack, 1969; Sagar & Bindra, 1976; Kamal & Kahn, 1977). Estimates of daily intake have ranged from 4.5 g/rat/day to 18 g/rat/day depending on both the number and types of foods offered.

These studies were carried out on several subspecies of *B. bengalensis*, most notably on *B. b. bengalensis* in Calcutta and *B. b. kok* in other parts of India (Ellerman, 1961). These subspecies are characterized as only medium-sized in terms of body weight and head and body length.

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The subspecies *B. b. varius*, an urban commensal rat in Rangoon, Burma, is however, an unusually large race (Ellerman, 1961). Except for some early studies of Harrison & Woodville (1950) on this subspecies no other detailed reports have been published on the food requirements of this larger race. Observations on the food requirements of this subspecies are presented here since many values are different from those reported by the above authorities.

2. MATERIALS AND METHODS

Lesser bandicoot rats were captured alive from several areas in Rangoon in locally-made wooden live traps baited with dried fish. Rats were sexed, weighed and housed individually in cages measuring 15×20×30 cm. The laboratory room was not airconditioned and animals were exposed to ambient temperatures ranging from 23° to 32°C. The rats were given a locally-milled laboratory diet consisting of 10 parts whole fish meal, 17 parts pressed peanut meal, 42 parts crushed rice, 15 parts corn meal, 15 parts rice bran and one part oyster shell. Using available information (Göhl, 1975), this diet was calculated to contain 3.14 kcal/g of metabolizable energy. A weighed amount of this laboratory meal was offered each day in a glass cup at the front of the cage. The residue remaining on the following day, plus any spillage caught on papers below each cage, was weighed to the nearest 0.1 g and the amount consumed calculated from the difference.

Animals were weighed once a week. Mean weight each week was determined by averaging the weight at the previous weighing with that of the succeeding weighing. If weight loss was shown for three consecutive weighings, the animal was removed from the study. The logarithm of mean daily food consumption per 25 and 50 g increments in body weight was plotted against the logarithm of body weight and the regression line calculated by the method of least squares (Simpson *et al.*, 1960).

3. RESULTS

The mean daily consumption of both male and female lesser bandicoot rats is given in Table 1. Juvenile rats (<50 g body weight) consumed up to about 16% of their body weight in food daily. This proportion decreased rapidly with increasing body weight; fully grown rats consumed only 3.5—5% of their body weight in food each day.

The exponential relationship between amount of food eaten daily and body weight is shown in Fig. 1, where the logarithm of food consumption (y) is plotted against the logarithm of body weight (w). The calculated line of best fit, $\log y = a + b \log w$ is given by: $\log y = .1786 + .4258 \log w$. The correlation coefficient equals .9815 ($P = .001$).

The estimated daily food consumption of a 50 g juvenile would be 8.0 g increasing to 24.6 g for a 700 g adult. Using the value of 3.14 kcal/g

Table 1

Amounts of laboratory meal consumed by lesser bandicoot rats per day.

Mean Body Weight (g)	Number of Observations	Mean Daily Consumption (±S.E.)		
		g/day	% of body weight	kcal/100 g BW
46.2	3	7.8—	16.9	53.0
62.5	12	8.7±.43	13.9	43.7
87.5	15	9.3±.40	10.6	33.4
124.5	28	12.1±.41	9.7	30.5
174.5	27	14.7±.56	8.4	26.5
224.5	37	16.1±.44	7.2	22.5
274.5	37	16.3±.50	5.9	18.6
324.5	39	16.0±.46	4.9	15.5
374.5	38	17.8±.47	4.7	14.9
424.5	23	19.2±.81	4.5	14.2
474.5	15	24.5±.40	5.2	16.2
524.5	14	24.2±.63	4.6	14.5
574.5	16	21.1±.88	3.7	11.5
624.5	14	23.2±.71	3.7	11.7
674.5	12	22.9±.68	3.4	10.7
724.5	15	24.2±.69	3.3	10.5

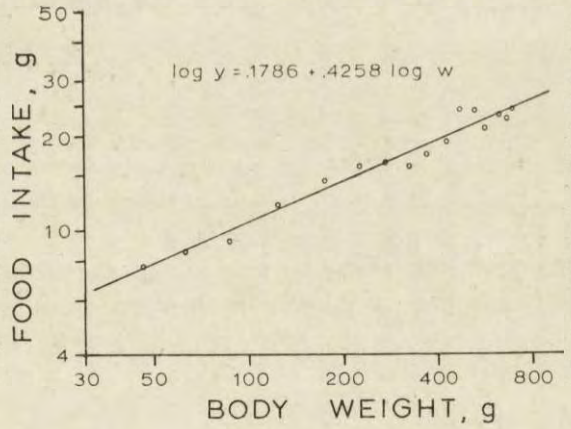

Fig. 1. Relationship of body weight to food intake in *B. bengalensis*.

of metabolizable energy for the laboratory diet, the caloric requirements of a 50 g juvenile would be 50 kcal/100 g body weight, while that of a 700 g adult would be 10.5 kcal/100 g (Table 1).

A separate analysis was made of food consumption during the 10 weeks of rapid and essentially linear growth in both sexes (the period

Table 2

Weight gain, food consumption and conversion ratio of male and female lesser bandicoot rats on a standard laboratory diet for 10 weeks (8 males, 8 females; means ± S.D.).

	Males	Females
Initial Weight, g	111.7±10.0	100.6±11.1
Final Weight, g	365.9±58.3	277.3±55.6
Weight Gained, g	254.1±58.1	176.7±49.3
IGR (%/week)	11.86	10.14
Daily Weight Gained, g	3.63	2.52
Daily Food Consumption, g	18.2	14.5
Conversion Ratio	0.199	0.174

of estimated age of 8 to 18 weeks). The sample consisted of 8 animals of each sex. Results are given in Table 2. Males consumed an average of 3.6 g more food daily than did females and, correspondingly, showed an average weight gain of 25.4 g ± 2.2 (S.E.) per week while females gained only 17.7 g ± 1.9 per week. The difference in mean weight gain between sexes is highly significant ($p = .01$). Males were observed to convert approximately 20% of their daily food consumption into an increase in body weight, whereas females converted only 17.4% into weight gains. This could indicate a basic physiologic difference in the sexes regarding utilization of nutrients and may account in part for the general observation that male rats grow more rapidly and to a greater body weight than do females.

4. DISCUSSION

Our finding that food consumption per unit body weight decreases from 16% of body weight for a 50 g juvenile to 3.5% for a 700 g adult agrees only at the larger body weights (400 g and over) with observations of Harrison & Woodville (1950) on this same species in Rangoon. They found the regression line of daily consumption of dry rice (y) against body weight (w) was fitted by the formula $\log y = -.44 + .65 \log w$. Calculations from this formula yield rather lower estimates for the smaller sized rats, with a 50 g juvenile estimated as consuming only 9% of its body weight in dry rice daily. We are unable to explain this discrepancy with our observations.

Sagar & Bindra (1976) studied food consumption of *B. bengalensis* in the laboratory on a variety of cereal grains and legumes. Using 8 rats of both sexes in the 185 to 250 g body weight size, they recorded daily consumption as a percent of body weight of 5%—7.4%, depending upon the type of food. The best weight gains were made on pearl millet, wheat, bengal gram and maize. Obviously, the amount of the different

foods consumed probably was related to their caloric value, but the authors did not explore this issue. They stated also that the daily intake in g/unit body weight ranged from 3.6 g for rats less than 50 g to 14.1 g in rats weighing more than 400 g. These amounts of daily consumption are considerably less than our observations.

Spillett (1968) found that lesser bandicoots in Calcutta consumed more food when given two foods daily rather than one. In the weight range of 218—253 g (average of 4 rats), his animals consumed 11.1—15.1 g daily of food mixtures (cereal grains and legumes). Again, these observations are below ours for the equivalent body weight classes.

Kamal & Kahn (1977) reported that *B. bengalensis* consumed 5.4 g/100 g body weight daily on cereal grains and 7.5 g/100 g body weight daily on cereal flours for groups of rats in the 170—224 g weight classes. These values, especially those of cereal flours, are consistent with our observations that rats from 174—224 g could be expected to consume 14.7—16.1 g of food daily.

Leslie & Ranson (1954) provide observations on the consumption of individually caged *Rattus norvegicus* feeding upon either whole of kibbled wheat. Combining and re-calculating their data for both sexes on both diets, we obtained the linear regression line of best fit of $\log y = .0599 + .5636 \log w$, with a correlation coefficient of 0.8683 ($p = .001$). The estimated daily consumption of wheat by a juvenile (50 g) Norway rat would be 7.9 g or 15.8% of its body weight. Consumption increased to 28.9 g daily for a 500 g adult, or 5.8% of body weight. Leslie & Ranson (1954) state that the temperature in the animal house where the rats were caged averaged about 21°C and ranged from 18° to 24°C. Thus Norway rats in the temperate climate area of England appear to consume more food per unit body weight than do bandicoot rats in the tropics.

Bharwaj & Kahn (1976) found that young *R. rattus* (50 g) in the Indian city of Aligarh, consumed daily an estimated 10.3 g of whole wheat meal (20.6% of their body weight). Food intake increased to 17.2 g daily for a 200 g adult (8.6% of body weight). These values are higher than those for reported for *B. bengalensis* and *R. norvegicus*. It is well established, however, that animals of smaller size, having a larger relative body surface area vs. mass, require more food per unit body weight to maintain homeostasis (Kleiber, 1947).

Lesser bandicoot rats from Rangoon consume more food per unit body weight than do members of this same species from Calcutta and Bombay. This is because the species in Rangoon is represented by adults that easily weigh twice as much as those from the Indian cities. Spillett (1968) found the maximum weight of wild male *B. bengalensis* trapped in

Calcutta was 370 g and for females was 325 g. Of 2356 males measured by Spillett, only 165 (7.0%) equalled or exceeded 300 g body weight, while for 1477 females only 20 (1.4%) equalled or exceeded this same weight. The maximum weight of a wild male lesser bandicoot trapped in Rangoon was 650 g and for females was 600 g. Of 2649 male rats from Rangoon, 1360 (51.3%) equalled or exceeded 300 g body weight and for females 1004 of 2485 (40.4%) equalled or exceeded this weight. Lesser bandicoots from Rangoon are easily the largest race of this species in Southeast Asia and the values presented here on food requirements of this larger subspecies may be typical for it only within its distributional range in central and lower Burma.

The mean weight of 5420 lesser bandicoots (both sexes) trapped in Rangoon during the period 1976 to 1979 was 280 g. Animals of this weight would consume daily an average of 16.6 g of laboratory meal under caged conditions. In the wild, a free-ranging animal would be expected to consume even more. In estimating the approximate number of lesser bandicoots feeding on census baits in Rangoon, we have used the above figure. The value of 9 to 11 g of cereal grains eaten daily, as given by Jackson & Temme (1979), is too low for *B. bengalensis*, even for India. A better value to use for estimating bandicoot consumption of cereal grains would be 13 to 18 g daily.

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REFERENCES

1. Bhardwaj D. & Kahn J. A., 1976: Food requirements of "Black rat", *Rattus rattus* L. J. Bombay Nat. Hist. Soc., *71*: 605—608.
2. Chitre G. D. & Deoras P. J., 1966: Observations on the feeding propensity and behaviour of rats. Proc. Indian Rodent Symp.: 145. New Delhi.
3. Ellerman J. R., 1961: Fauna of India including Pakistan, Burma and Ceylon. *Mammalia:* Vol. 3, *Rodentia*, Pt. 2: 817—834, Zool. Survey India, Calcutta.
4. Harrison J. L. & Woodville H. C., 1950: Notes on the feeding habits of house rats in Rangoon, Burma. Ann. Appl. Biol., *37*: 296—304.
5. Göhl B., 1975: Tropical Feeds. FAO Agric. Studies, No. 96: 1—661. FAO, Rome.
6. Jackson W. B. & Temme M., 1979: Rodents. Pt. 1. General considerations, direct measurement techniques, and biological aspects of survey procedures. [In: »Postharvest Grain Loss Assessment Methods«, Harris, K. L. and Lindblad, C. J. (eds.)]. American Assoc. Cereal Chemists: 101—107.
7. Kamal A. & Kahn J. A., 1977: Food preferences of the Indian mde rat, *Bandicota bengalensis* (Gray). Proc. Indian Acad. Sci., *86*B: 329—336.
8. Kleiberg M., 1947: Body size and metabolic rate. Physiol. Rev., *27*: 511—541.

9. Leslie P. H. & Ranson R. M., 1954: The amount of wheat consumed by the brown rat. [In: »Control of Rats and Mice«, Chitty D. (ed.)]. Clarendon Press, *2*: 335—349. Oxford.
10. Parrack D. W., 1969: A note on the loss of food to the lesser bandicoot rat, *Bandicota bengalensis*. Curr. Sci., *38*: 93—94.
11. Pingale S. V., Krishnamurthy K. & Ramasivan T., 1967: Rats. Food Grain Technol. Res. Assoc., India: 1—91. Hapur, India.
12. Sagar P. & Bindra O. S., 1976: Food and feeding habits of the lesser bandicoot rat. Pest Control., *12*: 28.
13. Simpson G. G., Roe A. & Lewontin R. C., 1980: Quantitative Zoology. Harcourt, Brace Co.: 1—440. New York.
14. Spillett J. J., 1968: The ecology of the lesser bandicoot rat in Calcutta. Johns Hopkins Univ. Centre for Medical Research and Training, Bombay Nat. Hist. Soc., Bombay 223 pp.

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ZAPOTRZEBOWANIE POKARMOWE *BANDICOTA BENGALENSIS VARIUS* (THOMAS, 1907)

Streszczenie

Osobniki z populacji *Bandicota bengalensis varius*, zamieszkujące okolice Rangunu w Birmie, osiągają często ciężar ciała dwa razy większy od ciężaru tego samego gatunku z Bombaju i Kalkuty. Konsumpcja pokarmu na jednostkę ciężaru ciała u tego większego podgatunku przekracza wartości opisane poprzednio dla innych podgatunków (Tabela 1). Zapotrzebowanie pokarmowe sięga od 16% ciężaru ciała u 50 g młodych osobników do 3.3% u 700 g otłuszczonych dorosłych (Ryc. 1). Młode szczury zużywają około 50 kcal/100 g ciężaru ciała/dobę, podczas gdy 700 g dorosłe, dla utrzymania ciężaru, jedynie tylko 10,5 kcal/100 g. Tempo przyrostu ciężaru ciała jest wyższe u samców niż u samic, a także stopień wykorzystania pokarmu na budowę tkanek jest nieco wyższy u samców niż u samic (Tabela 2).