THE WATER REQUIREMENTS OF THE AUSTRALIAN RODENTS, NOTOMYS ALEXIS, N. MITCHELLI AND PSEUDOMYS MINNIE

by

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SUMMARY

A study was made of the water requirements of three species of Australian rodents. The two desert species Notomys alexis and Pseudomys minnie were independent of drinking water when kept in the laboratory on a diet of hulled oats (10 percent water by weight) and at a temperature of 21°C and relative humidities between 30 and 60 percent. Notomys mitchelli, a species from the semi-arid parts of southern Australia, kept under the same conditions, was less tolerant to water deprivation with almost half of this species dying by the 30th day without water.

When denied water, all rodents lost between 15 and 20 percent of their body weight during the first 5 days. But thereafter, N. alexis and P. minnie gained weight so that after 60 days without water they had very nearly returned to their original weight. However, the N. mitchelli were still losing weight after 30 days without water.

Food intake, faecal water loss and faeces production all dropped markedly when the rodents were initially denied water, but increased again after the 10th day without water. However, the recovery of the food intake and faecal water

loss of N. mitchelli was much less than that of N. alexis and P. minnie.

Urine osmotic concentrations of all species reached a maximum after 3 days without water. Urine samples collected until the 7th day showed no further increase in concentration. Whether fed hulled oats or sunflower seed, N. alexis produced the most concentrated urine of the three species. Feeding the rodents sunflower seed, a food higher in protein than hulled oats, resulted in higher urine concentrations from only N. alexis and N. mitchelli. Apparently the Notomys were better able to concentrate urea than P. minnie. N. alexis fed sunflower seed produced urine with the highest osmotic and urea concentrations measured in this study with means of 4511 mOsm/l and 2985 mM/l respectively.

Associated with the increase in urine concentrations was a marked decrease in urine volumes. Mice denied water yielded only 3 to 7 percent of the urine of mice drinking. The Notomys, which concentrated their urine more than P. minnie, voided less urine per gram body weight.

When denied water, the N. alexis initially decreased their running in activity wheels on the average by 78 per cent. However, after 20 days without water, activity had risen to 50 percent of its initial level.

From these changes in body weight, food intake, urine concentrations and volumes, faecal water loss, faeces production and activity, it appears that the rate of metabolism of mice denied water initially decreased and so lessened the drain of water from their bodies. The first 3 to 5 days without water were a critical stage in their water balance, since it took this time for the major mechanism for conserving water, that of concentrating the urine, to reduce water loss to a minimum. As the withdrawal of water was sudden, this saving of water during the initial few days was important. This economy appeared to be accomplished by reducing metabolism.

Once urine concentrations reached their maximum, the rodents safely increased their food intake so avoiding possible starvation. The failure of N. mitchelli, the species least independent of drinking water, to recover its appetite completely further showed that food intake and hence metabolism, decreased in response to the severe stress placed on their water metabolism. Only when water balance was maintained did food intake remain normal.

Thus N. alexis, the desert species, is best equipped for living under conditions of extreme aridity. This species lost the least weight when denied water, was the quickest to regain this lost weight, and produced the

most concentrated urine. N. mitchelli, however, continued to lose weight while denied water, suffered the greatest mortality, and was less able to concentrate its urine. This latter feature is most likely responsible for the lower tolerance of N. mitchelli to water deprivation. P. minnie, though not able to concentrate its urine any more than N. mitchelli, survived without water as well as N. alexis. This somewhat paradoxical situation may be elucidated further by studying the evaporative water losses of these species.

The ability of N. alexis to concentrate its urine more than P. minnie may be a result of their longer time living under arid conditions, thus supporting Tate's (1951) suggestion of an early evolution of the Notomys in the desert and the Pseudomys in the more temperate south.

DECLARATION

This thesis does not contain any material previously accepted for the award of any degree or diploma at any University. Nor to the best of my knowledge does it contain any material previously published or written by any other person without due acknowledgement.

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