The effect of dehydration on blood glucose level in *Bufo gutturalis* (Power)

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Since the ability to accommodate the problems of dehydration is one of the chief factors governing the survival of terrestrial anurans, many investigations into the problems of anuran dehydration have been undertaken. Although many of these studies have dealt with dehydration and ionic balance (Bentley 1958, Vawda 1978 & 1979), some have dealt with dehydration and rehydration (Claussen 1969, Bentley, Lee & Main 1958), and a few with the correlation between temperature and dehydration (Schmidt-Nielsen & Forster 1954). As far as the authors are aware no attempt has been made to determine the influence of dehydration on the blood glucose level of anurans. Consequently this aspect was included as part of a larger study dealing with glucose homeostasis in the toad *Bufo gutturalis*.

Seven groups of seven toads each were acclimatized to laboratory conditions for one month. During this period the toads were fed daily on live insects and were housed in a large laboratory terrarium in which the natural habitat was simulated as closely as possible. The acclimatized toads were fasted for 48 h and then placed separately in open glass tanks (20 cm × 23 cm × 34 cm) to dehydrate (Vawda 1978). Dehydration was carried out at a mean relative humidity of 32 ± 4,9% and a mean temperature of 21,5 ± 1,0 °C. The degree of dehydration was measured as body mass loss.

Blood was drawn from the truncus arteriosus in a non-heparinized syringe and 0,1 ml of this sample was added to 1 ml 0,33N perchloric acid. The mixture was centrifuged and the supernatant collected for glucose analysis. Blood glucose was determined by the glucose hexokinase method (Epple, Jorgenson & Rosenkilde 1966, Gater & Balls 1977). In all cases blood glucose values were corrected to haematocrit 36 because this was found to be the mean haematocrit in normal control toads (*B. gutturalis*) over a two-year study period.

The toads in Group 1 served as controls and were sampled immediately after the fast. Groups 2 and 3 were dehydrated until they had lost 10% and 20% of their body mass respectively. Groups 4 and 5 were dehydrated until they had lost 30% of their body mass and Groups 6 and 7, 40% of their body mass. After dehydration the toads in Groups 2, 3, 4 and 6 were killed and blood was collected for glucose analysis. These results are graphically depicted in Figure 1 and summarized in Table 1.

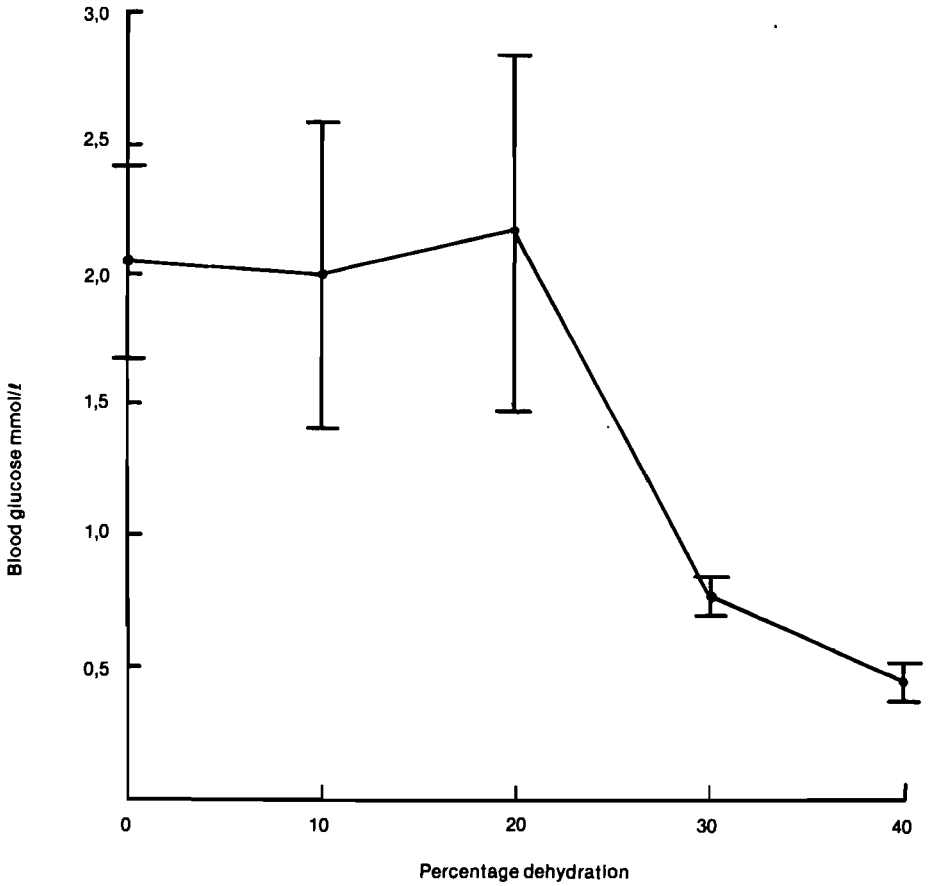

Figure 1 The effect of dehydration on blood glucose concentration in *B. gutturalis* (each point represents the mean of 7 observations; vertical bars show 1 standard deviation on either side of the mean).

Table 1 The effect of dehydration on blood glucose concentration in *B. gutturalis*

Group	Original mass (grams) $\bar{x} \pm$ SD	Percentage mass loss	Dehydration period (hours)	Haematocrit $\bar{x} \pm$ SD	Blood glucose mmol/l (Corrected to haematocrit 36) $\bar{x} \pm$ SD
1	35,8 ± 8,1	0	0	34 ± 4,6	2,07 ± 0,39
2	48,5 ± 9,1	10	17	38 ± 7,6	2,01 ± 0,60
3	59,1 ± 18,7	20	25	39 ± 3,4	2,20 ± 0,70
4	37,9 ± 9,3	30	41	40 ± 9,3	0,78 ± 0,08
6	42,8 ± 14,3	40	46	49 ± 6,7	0,45 ± 0,09

Table 2 The effect of rehydration on blood glucose concentration in *B. gutturalis*

Group	Original mass (grams) $\bar{x} \pm$ SD	Percentage mass loss	Rehydrated mass (grams) $\bar{x} \pm$ SD	Haematocrit $\bar{x} \pm$ SD	Blood glucose mmol/l (Corrected to haematocrit 36) $\bar{x} \pm$ SD
5	36,0 ± 12,6	30	36,3 ± 12,7	38 ± 0,9	0,64 ± 0,35
7	29,1 ± 9,6	40	29,4 ± 9,6	37 ± 1,7	0,59 ± 0,11

The results show that the blood glucose levels of the controls and of the 10% and 20% dehydration groups are similar. However, toads in the 30% and 40% dehydration groups exhibited marked hypoglycemia. In the former group the blood glucose level decreased by 62% to a mean concentration of 0,78 ± 0,08 mmol/l and in the latter group by 78% to 0,45 ± 0,09 mmol/l.

In order to determine whether dehydrated toads were capable of restoring glucose homeostasis after rehydration, Groups 5 and 7 were placed in water and allowed to rehydrate. Within an hour all the toads had rehydrated completely. These toads were then killed and blood samples were collected and analysed for glucose. These results (Table 2) indicate that although *B. gutturalis* dehydrated by 30% and 40% can rehydrate completely within an hour, it is unable to re-establish glucose homeostasis within the same period. *B. gutturalis* lost 10% of its body mass after a dehydration period of approximately 17 h, 20% after 25 h, 30% after 41 h and 40% after 46 h.

The authors are presently unable to explain the hypoglycemic effect of severe dehydration and it appears as though further investigations are necessary in this regard before any explanation can be suggested. However the possibility of hypoglycemia being due to the 'stress' of dehydration and experimental manipulation cannot be ruled out.

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