THE BEHAVIOUR OF Na DEFICIENT SHEEP

by

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(With 2 Figures)

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A sheep which loses 300-600 m. equiv. of NaHCO₃ daily from a permanent unilateral parotid fistula shows a greatly increased appetite for sodium. Under conditions of access for an hour only each day the voluntary intake of Na⁺ solutions offered approximates deficit, and further, if the concentration of the NaHCO₃ offered is varied over a wide range the animal adjusts the volume drunk so that intake remains relatively constant. The bulk of the voluntary intake occurs during the first few minutes of access to the solutions. Usually the sheep show a preference for NaHCO₃ over NaCl, a more appropriate choice in the face of the NaHCO₃ loss from the fistula. These results and those of earlier investigations have been reported in previous publications and the question of the extent of the central integration of these self-regulatory mechanisms with those controlling aldosterone secretion has been raised, (DENTON, GODING and WRIGHT 1959, 1960, DENTON and SABINE 1961).

It seemed that study of the changes of behaviour induced by Na⁺ deficiency, and close observation of the movements during sampling and choice of solution might advance understanding of the central nervous mechanisms involved in the appetitive and consummatory phases of these self-regulatory mechanisms.

The results reported here show that distance receptor stimuli presaging the imminent presentation of the solutions to a Na⁺ deficient animal induce a wide spectrum of visceral responses which are not observed in the Na⁺ replete animal. Study of the pattern of acceptance and rejection of solutions when access is first allowed has provided evidence of the specificity of the appetite for NaHCO₃.

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METHODS

The procedures for maintenance of sheep with a permanent parotid fistula in stainless steel metabolism cages, for presentation of water, NaHCO₃ and NaCl-420 m.equiv./l. and KCl-140 m.equiv./l. at zero time by removal of steel guards at the side of the cage, and for recording the sampling episodes and behaviour have been described previously (DENTON and SABINE 1961).

RESULTS

These include a general description of the behaviour of the colony of fistulated sheep in relation to the routine presentation of NaHCO₃ supplement, and includes measurement of visceral conditioned reflex responses. A behavioural abnormality is described also. A second section records the pattern of sampling of the solutions offered under conditions of Na⁺ depletion and repletion.

Behaviour changes observed during experiments on voluntary Na⁺ intake.

In our animal laboratory, 6-8 sheep with permanent unilateral parotid fistulae were kept in metabolism cages placed about 3 feet apart. There were openings at the front and sides sufficiently wide for the animals to see easily what was going on in the laboratory. By two to three months after arrival the majority of sheep were quite unperturbed by members of the staff moving close by them or spending all day in close proximity when this was necessitated by an experiment on a sheep in an adjacent cage. A fairly regular routine of feeding, and provision of water and Na supplement was followed in the laboratory each morning. The sheep took a lively interest in the proceedings. Some weeks after the regime of self selection of Na supplement was begun it was evident that preparation of these solutions provoked great excitement in a Na⁺ depleted sheep. When the usual person lifted the NaHCO₃ container from the shelf, commenced to weigh with the scales and add water to the usual tins, the sight and characteristic sounds caused bleating, stamping in the cage, a considerable increase in the rate of salivary secretion, and sometimes there was an attempt to stand on the back legs and peer over the top of the cage. The specificity of the interest and expectation was indicated by the fact that if a Na⁺ depleted animal were fed and was provided with water first, its behaviour was essentially the same during subsequent preparation of the Na solutions. It returned its attention to the food bin and ate only after it had drunk enough of the NaHCO₃ offered to satisfy itself.

As with the gregarious influence on eating already reported (DENTON,