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Studies of urinary and blood nitrogen curves after feeding in the dog.

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The following studies were designed to show the hourly variations in the normal dog of the total non-protein nitrogen of the blood compared with the output of urine and of the nitrogen in the urine and the effect upon these of various diets and of variations in the water intake.

Eight dogs have been placed on a diet consisting of meat, lard, sugar, sodium chloride, bone ash and water adequate in calories and containing about 0.4 gm. of nitrogen per kilo of body weight. On the sixth day the ration was varied to suit the study; in dogs 2 to 6 being richer in nitrogen, while in dogs 7, 8 and 9 no food was given on the days of the study. The water intake was varied as shown in the table. On the day of the study the animals were catheterized at intervals of two to four hours and at the time of each catheterization 5 c.c. of blood was taken from the jugular vein for estimation of the non-protein nitrogen by Folin's method. The urinary nitrogen was estimated by Kjeldahl. The results are shown in the table.

Conclusions.—The daily variation in the non-protein blood

nitrogen of the normal dog receiving a diet containing 0.4 gm. of nitrogen per kilo is about 9 milligrams, the maximum being reached about two hours after feeding with a return to the original level in about 10 to 14 hours. By feeding excessive quantities of meat the non-protein blood nitrogen may be increased 25 to 40 milligrams in 6 to 8 hours and the original level is usually not reached even at the end of 24 hrs. In one animal (Dog 4) the blood nitrogen did not reach its maximum until 14 hours after feeding; the urinary nitrogen exhibiting a parallel gradual rise; this is probably only to be explained on the basis of slow absorption from the gastrointestinal tract. It is to be observed that this animal received its allotment of water in small doses throughout the day by stomach tube instead of in one large dose with its feeding; this factor may have influenced the rate of absorption.

The curve of the non-protein blood nitrogen in the normal dog after feeding follows closely that of the urinary nitrogen. There is frequently exhibited, however, a further or secondary rise in the blood nitrogen at the time that the diuresis and output of nitrogen in the urine is rapidly decreasing.

In the fasting dog there occurs a gradual fall in blood nitrogen to a minimum of from 12 to 18 milligrams, reached 30 to 48 hours after the last feeding, and followed by a rise in the next few hours to about 25 milligrams at about which level it tends to persist. The urinary nitrogen shows a similar but less pronounced curve.

The amount of urine influences the urinary nitrogen to a much greater extent when the blood and urinary nitrogen values are high than when they are low. Free diuresis induced by the administration of water to the fasting animal has little effect upon the nitrogen curves.

The application of Ambard's formula to these data fails to give a constant figure. Better results are obtained by the use of a somewhat similar but simplified formula, but here also considerable discrepancies occur, and we have been unable to find any formula that will constantly express the relation between blood nitrogen, urinary nitrogen, and urinary amount.

| Hour. | Dog 9. Fasting. Water Given Ad Lib. (60 c.c. Taken in 40 Hours). | | | | Dog 1. Moderate Nitrogenous Diet; Water with the Feeding. Wt. = 10.870. | | | | Dog 2. High Nitrogenous Diet; Water with Feeding. Wt. = 6.200. | | | | Dog 3. Very High Nitrogenous Diet; Water with Feeding. Wt. = 7.600. | | | |
|-----------------|---|--------|--------|------------------|--|--------|--------|-----|---|--------|---------|--------|--|-----|--------|----|
| | Hours Since Feeding. | | Blood. | | Intake. | | Urine. | | Blood. | | Intake. | | Urine. | | Blood. | |
| | N. | Urine. | N. | Urine. | N. | Water. | Amt. | N. | N. | Urine. | N. | Water. | Amt. | N. | Urine. | N. |
| 10 A. M. | 24 | | 20 | 8:30 A. M. | 0.39 | 200 | | 23 | 1 | 100 | | 19 | 2.5 | 200 | | 25 |
| 4 P. M. | 30 | 6 | 0.16 | 10:30 A. M. | | | 30 | .34 | 28 | | | | | 11 | .52 | 29 |
| 10 P. M. | 36 | 6 | 0.15 | 12:30 P. M. | | | 23 | .44 | 25 | | 11 | .50 | | 35 | 1.02 | 39 |
| 8:30 A. M. | 46 | 6 | 0.19 | 2:30 P. M. | | | 17 | .33 | 22 | | 24 | .97 | | 30 | 1.22 | 42 |
| Noon. | 50 | 5 | 0.22 | 4:30 P. M. | | | 14 | .34 | 25 | | 9 | .63 | | 20 | 1.16 | 41 |
| 4 P. M. | 54 | 5 | 0.25 | 6:30 P. M. | | | 12 | .33 | 26 | | 9 | .51 | | 16 | .68 | 29 |
| 8 P. M. | 58 | 5 | 0.19 | 10:30 P. M. | | | 8 | .27 | 21 | | 8 | .37 | | 6 | .22 | 34 |
| 8:30 A. M. | 70 | 5 | 0.20 | 8:30 A. M. | | | 8 | .25 | 24 | | 3 | .16 | | 9 | .47 | 26 |

| Hour. | Dog 4. Very High Nitrogenous Diet; Water Throughout Day. Wt. = 12.150. | | | | Dog 7. Fasting; Water Once at 8:30 A. M. Wt. = 7.300. | | | | Dog 8. Fasting; No Water. | | | | Dog 5. Very High Nitrogenous Diet; Water with Feeding and Throughout the Day. | | | | Dog 6. Very High Nitrogenous Diet; No Water with Feeding; Water Once at 4:30 P. M. | | | |
|------------------|--|--------|--------|--------|---|--------|--------|--------|------------------------------|--------|--------|--------|--|--------|--------|--------|---|--------|--------|--------|
| | Intake. | | Blood. | | Intake. | | Urine. | | Intake. | | Urine. | | Intake. | | Urine. | | Intake. | | Urine. | |
| | N. | Water. | N. | Urine. | N. | Water. | N. | Urine. | N. | Water. | N. | Urine. | N. | Water. | N. | Urine. | N. | Water. | N. | Urine. |
| 8:30 A. M. | 2.5 | 40 | | 23 | 0 | 200 | | 20 | 0 | 0 | | 27 | 2.5 | 300 | | 22 | 2.5 | 0 | | 20 |
| 10:30 A. M. | 40 | 10 | .38 | 31 | | | 102 | .26 | 19 | | | | | 40 | 43 | .55 | 33 | 0 | 12 | .34 |
| 12:30 P. M. | 40 | 26 | .90 | 31 | | | 33 | .17 | 15 | | 6 | .25 | 25 | 40 | 162 | 1.31 | 38 | 0 | 65 | 1.39 |
| 2:30 P. M. | 40 | 35 | 1.35 | 37 | | | 13 | .15 | 13 | | | | | 40 | 120 | 1.47 | 39 | 0 | 72 | 1.85 |
| 4:30 P. M. | 40 | 30 | 1.36 | 42 | | | 7 | .13 | 12 | | 5 | .22 | 18 | 40 | 130 | 1.90 | 47 | 300 | 85 | 2.23 |
| 6:30 P. M. | 40 | 28 | 1.42 | 44 | | | 3.5 | .09 | 16 | | | | | 40 | 70 | 1.29 | 44 | 0 | 100 | 2.20 |
| 10:30 P. M. | 40 | 31 | 1.57 | 50 | | | 3.2 | .08 | 21 | | 5 | .19 | 22 | 40 | 77 | 1.55 | 43 | 0 | 52 | 1.83 |
| 8:30 A. M. | | 21 | 1.16 | 39 | | | 4 | .12 | 24 | | 6 | .26 | 25 | | 46 | 1.36 | 43 | 0 | 44 | 1.21 |

Intake = N of mixed diet in gms. per kilo of body weight.

Urine amt. in c.c. per 2 hrs.

N in grams per 2 hrs. (Kjeldahl).

Blood N in milligrams per 100 c.c. of blood (Folin).

¹ The amounts of urine and of nitrogen in the urine are expressed in c.c. and gm. *per 2 hours* for each period.