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The effect of light and of darkness on some urinary and blood constituents in the dog.

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As a part of the general problem of the influence of light on "normal" animals, a study is being made of changes induced in dogs subjected to longer or shorter successive periods of darkness and of light. At the present time we desire to report a series of results on certain chemical constituents of blood and urine.

Two female dogs, M and G, were brought into the laboratory on November 10, 1923, and placed in large metabolism cages. Dog M was a full grown adult weighing 17.2 Kg., while dog G was about a year old, weighing 12.8 Kg. The room in which the cages were kept was well ventilated and lighted, having a southeastern exposure. Temperature was read on a maximum and minimum thermometer, and registered a maximum variation of 4°C.; while wet and dry bulb readings showed the humidity to be constant.

The diet used was that recommended by Cowgill[1] supplemented by 40 mg. per kilo of Harris yeast vitamine powder made into special tablets containing 50 mg. vitamin extract and 50 mg. inert starch. The diet (see Table I) furnished 80 calories per kilo body weight, and has been shown to be ample for the maintenance of dogs under ordinary laboratory conditions.

The dogs were allowed to become accustomed to the food and surroundings, until analyses of urine and blood indicated nitrogen balance. Catheterization was done daily with due precautions against infection. Usually the urine was analyzed immediately. When this was impossible the sample was covered with toluene and kept in the refrigerator. The cages were cleaned daily to prevent contamination of the urine by hair and feces. When desired for analysis, blood was drawn from the femoral artery under oil, immediately after catheterization.

[1] Cowgill: *Journ. Biol. Chem.*, 1923, lvi, 725.

Standard methods were used in the urine analyses. The Folin-Wu tungstic acid system was used in the blood determinations. Ca and P were done according to Kramer and Tisdall.

On December 15 the room was made light proof. This was done in preference to moving the cages into another dark room in order to maintain the conditions as constant as possible. Feeding and taking of samples was done by the aid of a 15-watt ruby lamp aided by a small flashlight when such proved necessary. Extreme precautions were taken to guard the animals against undue exposure to even this amount of light.

The animals, though agitated for the first few days, as evidenced by incessant barking, gradually quieted down and soon seemed happy, consuming all their food regularly. On January 21 the shades were removed and light again admitted to the room. Once more the animals gave evidence of excitement, but again soon quieted down. Analyses were continued until January 31.

Table II shows the results of the analyses during the preliminary light period, the dark period and the subsequent light period. When the room was darkened the urine and the blood nitrogen increased in both dogs, more markedly in dog M, although dog G showed a proportional rise in blood non-protein nitrogen. In urine nitrogen, the change was latent. No analyses were made between December 18 and January 12, and it is probable that the rise observed on the latter date for dog G took place much earlier. There was no marked change in the percentage value of the various nitrogenous constituents. The phosphates showed no definite change in the urine, while the chlorides did. Blood sugar rose slightly. The acidity of the urine was at a higher level. Both dogs increased in weight. Many of the values decreased and were approaching normal at the end of the dark period.

On the day following the readmittance of light, there was a rise in nitrogen similar to, but proportionately more marked in dog M than that which occurred at the beginning of the dark period, and again of greater extent than in dog G. This rise soon subsided, and the constituents were already approaching their normal levels one week after light was admitted. Although urinary N values are lower than normal in the latter part of the dark period, we should hesitate to say that there was nitrogen

retention because of the small number of determinations carried out.

Other similar series of the same and of much longer duration have been run with comparable results.

TABLE I.

		Cal.	Percent
13.1% N, 80p.c. pure			
Casein	6.1 gm.	19.4	35.06
Sucrose	7.15	28.6	41.1
Butter fat	1.22		
Lard	2.33	32.0	20.4
Bone ash	.40		3.44
Salt mixture (Karr)	.20		
	17.40	80.	100.

Kilo unit contains 0.8 gm. N; 1 gm. contains 4.59 calories.

TABLE II.

Dog M					Urine						Blood							
Date	Wgt.	Vol.	Spec. Grav.	Acidity	Total N	Urea N	Creatinine	Creatine	Phosphates	Chlorides	Non-protein N	Urea N	Preformed Creatinine	Creatine + Creatinine	Uric Acid	Ca	P	Sugar
	K.	cc.		cc. N/10 NaOH	gm.	gm.	mg.	mg.	gm.	gm. NaCl	mg.	mg.	mg.	mg.	mg.	mg.	mg.	mg.
1923																		
Dec. 8	19.0	580	1.020	262	6.23	4.91	517.4	97.4	1.114	1.818	33.3	13.6			2.9			102.
11	18.3	290	1.032	182	6.39	4.87	415.0	115.0	1.025	1.56								
13	18.3	300	1.031	190	6.59	4.52	500.0	0	1.03	1.5	31.3	12.2	1.9	1.0	2.8			83.6
					Dark period beginning December 15													
18	18.3	340	1.045	260	14.98	12.6	500.0	440.0	1.315	2.2	69.		0.9	2.9				82.8
Jan. 12	19.1	340	1.032	226	6.76	4.01	275.0	250.0	1.115	2.36	30.7	14.4	1.8	2.2	1.7		4.9	77.8
15	19.1	355	1.031	235	5.14	3.56	410.0	95.0	0.870	2.29								
17	19.1	475	1.35	255	5.18	3.47	600.0	165.0	0.87	3.16	38.1	20.2	1.9	1.5	2.1	11.9		90.8
					Light period beginning January 21													
22	19.1	470	1.03	475	17.5	15.23	600.0	300.0	2.11		63.5	27.4	2.6	0.6	1.7	11.7		109.1
24	19.3	275	1.042	293	9.52	7.28	630.0	135.0	1.135									
26	19.2	315	1.025	200	9.51	8.12	473.0	0	1.145		30.3	16.6	1.6	1.9	1.8		4.8	103.4
31	19.2	360	1.025	105	7.46	5.74	476.0	49.0	0.905		29.	10.1	1.6	1.3	2.2	10.8		105.
Dog G																		
1923																		
Dec. 11	12.7	530	1.014	176	5.67	3.56	340	130.0	0.63	1.57	31.1	9.8	1.8	2.4	3.0			97.3
14	13.0	430	1.017	168	5.25	3.86	317	115.0	0.17	1.53		10.6	2.0		2.8			126.
					Dark period beginning December 15													
18	13.0	250	1.025	178	4.98	4.14	336	260.0	0.545	1.48	42.3		1.0	2.8				126.8
Jan. 12	14.1	300	1.033	258	6.51	3.73	320	110.0	1.145	1.55	31.6	12.6	2.4	1.9				96.6
17	14.1	175	1.038	193	4.62	4.12	323	0	0.91	2.64	31.6	16.7	2.8	0.9	3.9			141.8
					Dark period ending January 21													
22	14.4	175	1.037	163	4.42	3.27	325	175.0	0.92	1.53	34.5	16.8	1.8	2.6	2.0			155.4
24	14.3	190	1.039	228	5.98	3.95	450	190.0	1.165	1.37								
26	14.2	165	1.043	173	5.5	4.10	333	0	0.925	1.63	31.6	13.	1.6	3.3	2.3			109.
31	14.2	150	1.04	140	4.13	3.70	370	82	0.88	0.99	30.5	11.	1.7	3.2	2.4			93.