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Biotin Deficiency in the Dairy Calf.*

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During the course of the experiments on the development of a synthetic ration for the dairy calf (described elsewhere),[1] 2 of the animals developed a paralysis that was cured by the administration of biotin. This syndrome occurred when the animals were fed Ration No. 2. The composition of the diet is given in Table I.

The lard was homogenized into the solution of casein, salts and cerelose to produce a "synthetic milk" which contained 13% solids. All vitamin supplements were given at the morning feeding. For complete details on the preparation of the diet see Wiese, Johnson, Mitchell and Nevens.[1]

The first animal, calf No. 7, having been on Ration 2 for 19 days, developed a paralysis of the rear legs and was unable to rise. The calf, very unsteady when placed on his feet, was incapable of muscular coordination of the hind legs and fell when trying to walk.

An attempt was made to cure the condition by giving the animal 25 g of Wilson's 1-20 liver powder in the morning feeding. A slight improvement was shown by afternoon. The following morning, the paralysis had disappeared, and the calf was able to rise without assistance and walk normally. The animal, continued on Ration 2, exhibited the same paralytic symptoms 22 days later. The calf was given 100 μg of biotin by subcutaneous injection. In 24 hours the symptoms had disappeared and the animal had recovered completely.

Calf No. 7 developed the identical symptoms a third time 13 days later and was cured again by the subcutaneous injection of 100 μg of biotin.

A second animal, calf No. 9, having been on the diet for 50 days, showed the same symptoms as calf No. 7. The calf was given 100 μg of biotin by subcutaneous injection. When the condition of the animal did not improve, 1 mg of biotin in glucose was administered by intravenous injection. The next day the animal had recovered completely.

TABLE I.
Composition of Ration 2.

Component	%	Vitamin added	Mg/kg liquid ration
Casein "Labco"	30.0	Thiamin	0.65
Lard	26.6	Riboflavin	0.65
Salts 1	6.0	Nicotinic acid	2.60
Cerelose	37.4	Pyridoxine	0.65
		Calcium pantothenate	1.30
		Ascorbic acid	13.0
		α-Tocopherol	1.0
		2-Methyl-1,4-naphthoquinone	0.26
		Vitamin A	5000 I.U./day
		Vitamin D	500 I.U./day

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1 Wiese, A. C., Johnson, B. Connor, Mitchell, H. H., and Nevens, W. B., *J. Dairy Sci.*, in press.

TABLE II.
Urinary Excretion of Biotin.

Date	Symptoms	Treatment	Excretion γ/day	Date	Symptoms	Treatment	Excretion γ/day
		Calf 7.				Calf 9.	
Born 1-28-46				Born 2-12-46			
2-12	—		5.2	2-23	—		1.9
13	—		4.4	24	—		3.1
17	+			4-5	+	100 γ biotin	—*
18	+	25 g liver	—*	6	—		
19	—						
3-12	+	100 γ biotin	—*	18	—	On starch containing diet	10.5
13	—			19	—		15.1
25	+	100 γ biotin	—*	5-17	—		25.6
26	—			29	—		10.7
4-1	—	On starch containing diet		6-6	—		21.2
5-4	—		14.6				
29	—		10.6				
		Calf 11.				Calf 12.	
Born 4-24-46				Born 4-24-46			
4-26	—	On colostrum	46.4	4-26	—	On colostrum	35.1
5-3	—	On synthetic milk diet	4.4	5-3	—	On synthetic milk diet	2.1
4	—		5.3	4	—		3.9
9	—		2.5	9	—		3.2
10	—	+ biotin†	5.7	10	—	+ biotin†	8.2
18	—		7.3	18	—		5.4
24	—		7.6	24	—		4.8
29	—		10.6	6-1	—		12.6
6-4	—		14.3				

* Urine samples not obtained due to scouring.
† Biotin added to the "synthetic milk" diet at the rate of 10 μg per 1000 cc of milk.

Calves No. 7 and 9 were changed to a solid diet containing considerable amounts of starch when 7 weeks old. On this diet the animals did not exhibit any paralytic symptoms.

During the course of the experiment 24-hour urine collections were made. The amount of biotin excreted was determined by the method of Wright and Skeggs.[2] The data are given in Table II. At the age of 2 weeks, calves No. 7 and 9 excreted only a small amount of biotin in the urine. The increase in biotin excretion by these animals during the latter stages of the experiment is probably due to the change to a solid diet containing considerable amounts of starch. On this type of ration intestinal synthesis of the B-vitamins, including biotin, probably occurred, accounting for the increased biotin excretion in the urine.

Calves No. 11 and 12 were maintained on the liquid "synthetic milk" diet. Biotin was not supplemented for the first 2 weeks. After this time 10 μg of biotin were added per kg of liquid ration fed. The first urine sample was obtained when the calves were 48 hours old and had received colostrum. The data in Table II reveal that the biotin excretion was high at this time. After one week on the biotin-deficient ration the urinary biotin excretion had dropped to 3 to 5 μg per day. After the supplementation of biotin was begun, there was a gradual increase in the urinary excretion of biotin. These 2 calves grew normally and did not show any symptoms of biotin deficiency during the time they were on the experiment.

Summary. The young dairy calf requires an exogenous supply of biotin; otherwise a paralysis of the hind quarters develops, curable by biotin administration.

2 Wright, L. D., and Skeggs, H. R., PROC. SOC. EXP. BIOL. AND MED., 1944, **56**, 95.