

THE ANTIRACHITIC EFFECTIVENESS OF FALL AND WINTER SUNSHINE¹

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Ordinarily it has been assumed that the sunshine of the late fall and winter in this latitude has little, if any, anti-rachitic effectiveness. Physical measurements of the amount of ultra violet light reaching the earth's surface at this season of the year tend to support this contention. The anti-rachitic effect is further reduced by the interference of clouds, smoke, and shadows. At our station we have accumulated some evidence from animal responses which suggest somewhat more effectiveness for the sunshine of this season of the year than the physical measurements and earlier observations seemed to indicate.

In connection with our study of the vitamin D deficiency of dairy cattle we have made observations on three cows which shed some light on this problem. Evidence from one of the animals (6-E) has been summarized in tabular form below.

Before Sunshine Exposure			After Sunshine Exposure		
I. Physical Condition					
1. Very stiff—back humped			1. Stiffness improved after two days—Still more improved in 5 days—Was moving slowly but without much stiffness in 10 days—Joint swellings were reduced.		
2. Not eating very well			2. Eating better in four days—Soon cleaned up all her ration.		
II. Blood Chemistry					
mgm. per 100 cc			mgm. per 100 cc.		
	Ca	P		Ca	P
8/19-21/37	6.05	1.87	8/26-28/37	8.36	4.04
			9/4-6/37	11.35	5.14
III. Mineral Balances					
10-day period					
	Ca	P Milk		Ca	P Milk
		daily			daily
	gm	gm lbs.		gm	gm lbs.
7/27-8/6/27	-52.07	-26.71 4	9/14-24/37	+157.04	+76.46 4
8/10-20/37	+11.05	-24.79 4	11/9-19/37	+158.33	+71.73 37

¹S. Dak. Agric. Experiment Station Journal Series No. 153.

IV. Vitamin D in Butterfat

0.00 I. U. per gram—10 rats given dose of 12 grams butterfat. Only one showed any healing. Cow nearly dry.	0.20 I. U. per gram—10 rats given dose of 12 grams butterfat. Average healing of 0.50+ Three weeks after freshening.
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The information in the table shows how the severe physical symptoms of the vitamin D deficiency were quickly relieved after the cow was turned out into the sunshine on August 20. The sunshine exposure continued until about October 1 when the cow freshened. The table also shows that the calcium and inorganic phosphorus of the blood plasma were extremely low before sunshine exposure, but had shown a decided improvement within a week and were at normal levels in a little over two weeks. The ability of the animal to utilize ingested calcium and phosphorus for body purposes is revealed in the results of the mineral balance trials. The trials before exposure show negative results (one slightly positive) even though the animal was practically dry and normally would be building up mineral reserves. After sunshine exposure the mineral balances are strongly positive. This is especially noteworthy in the case of the second trial after exposure because the cow had freshened previous to the time this trial was run. Under stress of a heavy milk flow cows are often in negative mineral balance for some time after freshening under normal conditions, and the fact that this animal was strongly positive at this stage of lactation indicates that she was taking advantage of the vitamin D afforded by the fall sunshine to replenish her depleted reserves of calcium and phosphorus in spite of the heavy draft on these minerals caused by a liberal flow of milk. Lastly, no vitamin D could be detected in a sample of butterfat saved just before sunshine exposure but following sunshine exposure and subsequent freshening a sample of butterfat was found to contain 0.20 International Units per gram. These facts give unmistakable evidence of the anti-rachitic effectiveness of fall sunshine.

Another animal, 12E, became depleted still later in the fall and was turned out for sunshine on Nov. 13. Thus these

studies were made right up to the time when the days are the shortest and the antirachitic effectiveness supposedly at a minimum. The fall weather was unusually good this season and the cow got more sunshine exposure than would ordinarily be available at this time of year. The animal was approaching the end of her lactation so milk production did not add appreciably on the physical condition, total calcium and inorganic phosphorus in the blood plasma, mineral balance trials, and the concentration of vitamin D in the butterfat and blood plasma both before and after sunshine exposure. The evidence uniformly supports the conclusion that the antirachitic effectiveness of late fall and winter sunshine as measured by these dairy cows is pronounced and may be more significant than previous observations and physical measurements of the amount of ultra-violet light reaching the earth's surface at this season might indicate. Of course these beneficial effects could be obtained only when the weather was not so severe as to prohibit turning the animals out doors.
