

THE SYNTHESIS OF VITAMIN C BY THE DAIRY COW

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The observations reported in this paper are an outgrowth from our studies on the vitamin D deficiency of mature dairy cattle. In setting up the ration for the vitamin D experiment care was taken to make it adequate in all respects except for the factor to be studied, namely, vitamin D. Little attention was paid to the vitamin C content of the ration as it has been generally understood that a food source of this factor was not necessary for the adequate nutrition of cattle. After the experiment had been under way for a considerable time certain observations were made which raised the question as to whether the vitamin D deficiency might also be complicated with evidences of a vitamin C deficiency. Chief among these observations were an extreme looseness of the teeth, both the incisors and molars, and a distinct atrophy and sponginess of the gum tissues, especially around the lower incisor teeth. A check-up on the ration showed that it was low in vitamin C as well as deficient in vitamin D. Some of the animals had been on this ration two or three years which constituted a more severe test than has customarily been employed when studying the requirement of the bovine for vitamin C. It was decided to make some further studies to clarify this problem.

Plans were made for running indophenol titrations for vitamin C on the blood and milk of these experimental cows together with similar observations on three other groups of cows getting variable amounts of vitamin C in their rations. If the experimental cows were really deficient in vitamin C it should be indicated by a low concentration of this factor in the blood which would in turn mean only limited amounts available for secretion in the milk. The following four groups of cows were used.

1.—The vitamin D experimental animals on a ration very low in vitamin C.

2.—Animals getting only alfalfa hay and a grain mix. This ration would also be limited in vitamin C but perhaps

would supply a little more than the cows on the vitamin D experiment received.

3.—Cows from our main dairy herd getting alfalfa hay, corn silage (a fairly good source of vitamin C) and a grain mixture.

4.—Cows from the main dairy herd that were out on pasture during the summer season. Pasture furnishes liberal amounts of vitamin C.

The vitamin C observations were started last June and results are now available for 110 months. At least two blood samples and an A. M. and a P. M. milk sample from each of the cows in milk have been collected from each animal monthly. The results of these studies are summarized in the following table.

Vitamin C in the Blood and Milk of Dairy Cows Receiving Varying Amounts of Vitamin C

Material Tested	Group 1 Exp. Cows ration low in Vitamin C	Group 2 Cows on alfalfa hay and grain mix	Main Herd	
			Group 3 Alfalfa hay, corn silage, grain	Group 4 Pasture and grain
Blood plasma-mgm vit. C per 100 ml.				
A—Summer season	.366		.320	.248
B—All analyses (June-Mar.)	.369	.446	.320	
Milk-mgm Vit. C. per 100 ml.				
A—Summer Season	1.814		1.771	1.803
B—All analyses (June-Mar.)				
A. M.	1.705	2.030	1.793	
P. M.	1.793	2.068	1.794	
	1.749	2.049	1.793	

By referring to the table it may be seen that the concentration of vitamin C in the blood plasma of the experimental cows in Group 1 receiving the ration very low in vitamin C, averaged somewhat higher than for the cows in the main herd which were receiving quite liberal amounts of vitamin C. This was true for the summer pasture season as well as for the main herd average for the entire year. The figures for the experimental group were slightly less than for the two cows in Group 2 receiving alfalfa hay and a grain mix. The vitamin C concentration in the milk from the different groups is also strikingly similar with no significant variation between the morning and evening samples in any case.

Plans are now under way for making a quantitative determination of the vitamin C intake and of the outgo in the urine for the cows in Group 1 with possibly some comparative figures for the urinary excretion of vitamin C for the cows in the other groups.

As the concentration of vitamin C in the blood plasma and the amount secreted in the milk of the experimental animals in Group 1 are comparable to similar figures for cows receiving increasing amounts of vitamin C in their rations there seems to be no indication that these animals were suffering from a vitamin C deficiency. The available data lend support to the view that the bovine is able to synthesize vitamin C and is not dependent upon a food source for this factor.