A REPORT ON THE OCCURRENCE OF RICKETS IN CALVES UNDER FARM CONDITIONS

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That growing calves need vitamin D has been established by work carried out at the Pennsylvania (1, 2), Michigan (3), Wisconsin (5) and other experiment stations. Under proper feeding and management practices vitamin D deficiency resulting in rickets in calves is easily prevented. However, unless practices which favor the development of rickets are recognized and avoided, disastrous results may ensue. The increasing number of field cases of rickets in calves which have been reported indicates that improper feeding and management of growing calves occur on farms more than might be expected.

The following report of 9 cases of rickets in Guernsey calves on a farm in Wayne County (Ohio) will help to point out some of the factors involved in rickets developed under farm conditions.

FIELD CASE HISTORY

In late February, 1942, 9 Guernsey calves from 3 to 6 months of age were brought to our attention because of their abnormal appearance and behavior and the failure of one calf with severe symptoms to respond to veterinary treatment.

The owner reported that the calves were allowed to nurse from 4 to 6 weeks after which liberal grain feeding was started. The calves had access to alfalfa and timothy hay of good quality, but due to the large amount of grain fed very little hay was consumed. It was pointed out that the hay was made in exceptionally dry weather and was cut one day and hauled the next, which gave it a minimum of exposure to sunlight. The calves were born in the fall and had either been kept in box stalls or allowed to run loose in a covered straw-shed.

When first seen one calf was so severely afflicted that it was unable to rise. Its legs were bent at the knees and pasterns. Its back was roached and the calf lay in a distorted position, as can be seen in figure 1. This calf died within a few days.

The bones of this calf were very soft and could readily be cut with a butcher knife. An ash determination on a section of the femur yielded a value of 54.3 per cent, which is in close agreement with values for rachitic calves reported by Krauss and Knoop (4).

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Fig. 1. Calf in advanced stages of rickets. This calf died a few days after the picture was taken.

The other calves were not as far advanced but all of them showed varying degrees of stiffness in their joints, especially upon rising. Several had front legs that were bowed at the knee and most of them had roaches (upward curvature) in their backs. All the calves looked well grown and well nourished.

It was believed that the calves were suffering from rickets due to a vitamin D deficiency. Two of the worst cases (fig. 2) were moved to a box stall and blood samples taken for analysis. These two calves were each fed 500,

<table>
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<th>Date, 1942</th>
<th>Calf number 1</th>
<th>Calf number 2</th>
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<tbody>
<tr>
<td></td>
<td>Calcium</td>
<td>Phosphorus</td>
</tr>
<tr>
<td></td>
<td>mg.%</td>
<td>mg.%</td>
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<tr>
<td>3/2</td>
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* 500,000 units of vitamin D in the form of irradiated yeast fed both calves beginning February 25, 1942, and ending March 2, 1942. After March 3, the grain mixture containing irradiated yeast was fed.
† Phosphatase units per 100 cc. of serum (a unit of phosphatase is defined as equivalent to 1 mg. of phosphorus liberated from a sodium glycerophosphate substrate as the phosphate ion during the first hour at a pH of 8.6 and at 37° C.).
000 units of vitamin D in the form of irradiated dry yeast\(^1\) daily from February 25 until March 3.

Analysis of the blood of these two calves showed that before yeast feeding was begun both serum calcium and phosphorus were low for calves of that age and the serum phosphatase was extremely high. This is a typical blood-picture of rickets. By March 2 both calcium and phosphorus had increased markedly but the phosphatase still remained high, as shown in table 1.

On March 3 these two calves and the other six were started on the following grain mixture:

- 100 pounds yellow corn
- 150 pounds oats
- 50 pounds wheat bran
- 50 pounds linseed oil meal
- 50 pounds fishmeal
- 4 pounds steamed bone meal
- 4 pounds ground limestone
- 4 pounds iodized salt
- 0.5 pounds irradiated yeast\(^2\)

This grain mixture was supplemented with liberal amounts of good quality mixed alfalfa-timothy hay.

The two calves that had been fed massive doses of irradiated yeast showed immediate improvement and within three weeks calf No. 1 was turned into the straw-shed with the other six. One week later the other calf (No. 2) was taken from the box stall and put with the others. It was still rather stiff and somewhat distorted but much improved.

After four weeks the blood calcium and phosphorus had become normal and the phosphatase was much reduced (Table 1).

All external symptoms had disappeared in the six less severe cases after four weeks. Marked improvement in the two worst cases continued throughout the succeeding weeks.

Thirty months later (September 30, 1944) the same animals were again observed near the end of their first lactation. In most instances the cows were quite normal in appearance. This indicates that unless rickets is too far advanced the damage to the bones can be corrected. However, the cow that had been calf No. 1 still showed a slight roach in the back and an abnormal curvature of the neck (fig. 3). This suggests that if the disease is far advanced before administration of vitamin D the skeletal changes become more or less permanent.

\(^1\)9E irradiated yeast containing 4,000,000 U.S.P. units of vitamin D per pound. Obtained from Standard Brands, Inc., 595 Madison Avenue, New York City.

\(^2\)This large amount of irradiated yeast was added because of the severity of the condition of the calves to which it was fed. Ordinarily 0.5 pounds per ton of calf mix is adequate.
FIG. 2. Two of the most severe cases that survived. The front calf at the top is No. 1 and the calf in the rear is No. 2.

DISCUSSION

The two main natural sources of vitamin D for calves are sunlight and good quality sun-cured hay. The calves described in this report were born in the fall and were kept in the barn all winter; therefore, they had never been exposed to sunlight. This was due primarily to lack of a suitable lot near the barn. An exercise lot exposed to the sun is an important consider-

FIG. 3. This cow was calf No. 1. She still shows an abnormal curve in her neck and has a roach in her back which is plainly seen when she walks.
ation from the management standpoint. The long nursing period served to deplete the calves' natural store of vitamin D since winter milk contains little vitamin D. The long nursing period, followed by heavy grain feeding, permitted rapid growth, but kept hay consumption at a minimum. Thus, vitamin D intake was low since sun-cured hay is the principal feed source of vitamin D for calves.

The feeding system used on this farm is not much different from that used by a great many dairymen. This would indicate that many calves, especially those born in the fall, may suffer from subclinical vitamin D deficiency and that some minor change in feeding or management might easily bring on rickets in the active form. It would seem to be a desirable practice, therefore, to supplement the ration of young calves with vitamin D. Irradiated yeast, activated animal or plant sterols, cod liver oil, or fish liver oil concentrates are all suitable sources of vitamin D. The commercial practice of adding one-half pound of irradiated yeast per ton of calf feed, or 1 per cent of vitamin D feeding oil, or 0.25 per cent of fish liver oil concentrate to the feed supplies the minimum requirement plus variable margins of safety. These vitamin D sources are equally effective for calves and should be selected on the basis of cost per unit of vitamin D, availability and convenience. Other vitamin D preparations should be fed according to their potency so as to supply 400 U.S.P. units per 100 lb. of body weight. Exposing the calves to sunlight in suitable weather and offering sun-cured hay after the first week or ten days are desirable practices.

REFERENCES