Effect of Three Levels of Carotene Intake During Lactation on the Performance of Beef Cows and Their Calves

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Nearly ten years of vitamin A research have been completed a this station dealing with the requirements of beef cattle. The resul indicate that mature beef cows can store sufficient amounts of vitami A in the liver during a normal green pasture season to supply thei needs for considerable time when fed rations devoid of carotene. Suc liver stores may be sufficient to maintain the health of the cow for mor than a year, but may not be enough to provide for transfer of vitamin A potency in the milk such that the calf is protected from a deficiency Therefore, recent work has centered around the requirements of lacta ing beef cows in order to protect the calf against a vitamin A deficiency The results reported herein are from the second trial, involving thre levels of carotene fed to lactating beef cows which were partially de pleted of liver vitamin A stores at calving time. (The results of th first trial were reported in the Okla. Agr. Exp. Sta. Misc. Pub. MP-48.

Procedure

Sixteen, bred, coming three-year-old Hereford heifers were selecte from the Lake Carl Blackwell herd in the fall of 1956. The heifer were wintered on dry, weathered, native grass at the Lake Blackwel range, with 2.5 pounds of cottonseed meal per head daily and mineral free-choice, until mid-February. On February 15, 1957, the heifer were moved to dry lot. They were fed a ration consisting of weathered native grass hay (cut in December and devoid of carotene) ad lib plus 5 pounds of ground milo and 3 pounds of cottonseed meal pe head daily. A mineral mixture of two parts salt and one part steame bone meal was available to the cows, free choice. The cows were con tinued on the same ration until the experiment was terminated at th end of the third month of lactation.

After calving, the cows were divided into three lots and receive a carotene supplement* mixed with the concentrates and fed individual ly, twice weekly, at levels that would provide 0, 5 and 10 mg. of caroten per hundred pounds of body weight per day during the three month of lactation. The levels of 5 and 10 mg. of carotene per cwt. daily wer approximately 50 and 100 percent of Morrison's recommendations fo beef cows during lactation.

The cows and their calves were removed from the experiment whe the calves had reached three months of age. All calves had access to a creep-feed devoid of carotene. Data were obtained on the body weight

* The carrot oil concentrate used was generously supplied by Nutritional Research Associates Inc., South Whitley, Ind.

of the cows and calves at parturition and at monthly intervals. The calves were closely observed throughout the experiment for symptoms of vitamin A deficiency and a record was maintained on scours and other abnormalities during the course of the study. Blood samples were taken from the cows in early March before calving, at parturition and at 1, 2 and 3 months after calving. The calves were bled as soon as possible after birth and at 1, 2, and 3 month intervals. Liver samples were taken by the biopsy technique from the cows at parturition and at the end of three months lactation. Liver samples were taken from the calves at three months of age. Milk samples were taken from the cows at the end of three months lactation.

Results

A summary of the data obtained is presented in Table 1. This includes the weight changes of the cows, birth weights of the calves, and gains of the calves to three months of age. Other data shown are the plasma carotene and vitamin A levels of the cows and calves at parturition and at 1, 2, and 3 months post-partum; also the liver vitamin A levels of the cows at parturition, and of the cows and calves when the calves were three months of age.

No deficiency symptoms were observed in the cows during this study. Carotene supplementation during early lactation had no consistent effect on the weight gains of the calves to three months of age. However, two calves were lost in Lot 1 whose dams received no supplemental carotene during lactation. The losses appeared to be due to secondary infections, perhaps due to low vitamin A nutrition. There was wide-spread incidence of scours in calves of all lots that did not seem to be associated with the amount of carotene given the dams. Plasma carotene and vitamin A levels of the cows and their calves tended to reflect the level of carotene fed during lactation. The plasma carotene levels of the cows were found to be significantly higher in the lots receiving supplemental carotene at 1, 2, and 3 months following parturition. Plasma vitamin A levels tended to lag behind carotene, but were significantly different at two months after parturition.

The plasma carotene levels of the calves from supplemented dams were significantly higher at three months of age. In terms of depletion of liver stores, cows fed the highest level of carotene intake showed less depletion of liver stores during lactation, although cows of all lots were depleted of liver stores during the three-month lactation period. Liver vitamin A levels of all calves were surprisingly low at 3 months, but did reflect the level of carotene given their dams.

It appears from this and other work that beef cows, if depleted of their liver vitamin A stores during gestation, must receive relatively large amounts in the feed during lactation in order to maintain the blood levels of their calves. None of the levels used in this study was sufficient to prevent further depletion of the cow's liver stores during lactation. The highest level of carotene supplementation practiced in this study would approximate the feeding of 6 to 8 pounds of average

Table 1.—Effect of three levels of carotene intake during lactation on the performance of beef cows and their calves.

Carotene intake of cows per cwt. per day during lactation.	Lot 1 0 mg.	Lot 2 5 mg.	Lot 3 10 mg.
Number of cows per lot	5	5	6
Average cow weights (lb.)			
At parturition	849	738	843
Loss first 3 months lactation	—9	—85[1]	—25
Average calf weights (lb.)			
At birth	73	69	58
Gain to 3 months of age	100[1]	94[1]	95
Plasma carotene (mcg./100 ml.)			
Cows: parturition	37.9	46.7	55.1
1 month	40.8	104.8	192.8
2 months	25.8	111.5	258.2
3 months	23.9	114.0[2]	275.4
Calves: Birth	15.3	10.0	12.1
1 month	16.8	12.8	11.9
2 months	10.4	18.4	18.2
3 months	12.1[2]	29.1[2]	41.3
Plasma vitamin A (mcg./100 ml.)			
Cows: parturition	15.4	12.1	18.4
1 month	15.7	16.0	18.1
2 months	7.6	17.0	19.0
3 months	10.0	14.3[2]	16.2
Calves: Birth	17.4	16.3	14.5
1 month	12.0	7.3	15.7
2 months	7.1	7.2	8.3
3 months	4.6[2]	4.8[2]	6.3
Liver vitamin A (mcg./gm dry matter)			
Cows: parturition	64.0	80.7	78.6
3 months	23.8	11.4	46.5
Calves: 3 months	4.5	5.4	8.2

[1] Does not include weights on cow from Lot 2 that died of unknown cause, or her calf, or from 2 calves of Lot 1 that died during third month of experiment.
[2] Blood samples not obtained from cow of Lot 2 that died during third month, or her calf, or from 2 calves in Lot 1 that died.

quality alfalfa hay per head daily. Calves in this study had adequate plasma vitamin A levels at birth, but were soon depleted to a deficient or borderline condition in three months.

The vitamin A values of milk samples from cows taken at 3 months lactation were 4.83, 4.03, and 7.12 mg. per 100 ml. for Lots 1, 2, and 3, respectively. In view of the poor transfer of vitamin A and carotene through the milk of the beef cow, it would appear that supplying the calf with vitamin A directly may be the most efficient method wherever possible.

Summary

Further tests were conducted to study the effect of different levels of carotene intake during early lactation on beef cows which had been partially depleted of their vitamin A stores prior to calving. Sixteen, pregnant, three-year-old Hereford heifers were divided into three lots and received 0, 5, and 10 mg. of carotene per 100 lb. body weight per day for the first three months of lactation. Data obtained indicate little effect of carotene supplementation on the weight changes of the cows or gain of the calves to three months of age. However, two calves were lost from cows receiving no supplemental carotene. Plasma carotene and vitamin A levels of the cows reflected directly the levels of carotene fed. Liver stores in all the cows were depleted regardless of level of supplementation, but tended to be depleted at a less rapid rate with cows receiving the most carotene. Blood and liver levels of all the calves appeared dangerously low, even at the highest level of carotene supplementation of their dams. It appears that large amounts of carotene must be fed the lactating beef cow in order to permit transfer of sufficient vitamin A through the milk to protect the calf against a deficiency and to avoid death loss.

Performance Testing Boar Pigs

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To gain information on performance testing boars for rate of gain, economy of gain and probe backfat thickness, individual feeding tests of boar pigs were initiated at Fort Reno in 1954. The records of 138 of these individually fed boars have been included in this study. Sixty Line OK3 Duroc boars and 78 Line OK14 Hampshire boars were fed.

Test Procedure

Boars were selected for the feeding test when weaned at 56 days of age. At weaning, the boars were taken to the Boar Test Barn and placed on the test ration. When each boar weighed approximately 50 lbs., he was started on the feeding test. As each boar reached approximately 170 lbs. he was weighed off the test, but a limited number of boars weighed over 180 lbs. when removed from the test. At the conclusion of the test each boar was probed in four places for backfat thickness. Two probes were made on each side of the back about 1½ inches off the midline. The front probes were made about 2 inches behind the shoulder and the rear probes were made over the center of the loin. The four probes were averaged and adjusted to a 170 lb. standard weight.

The ration fed each season varied somewhat but was essentially the same except for two seasons in which wheat or milo was substituted for corn (Table 1). Beginning with the 1956 Fall farrowed boars, the ration