

THE EFFECT OF CAROTENE INTAKE BY HEREFORD COWS ON CALF GROWTH

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Under sagebrush-bunchgrass range conditions the short season on green feed has led to speculation that vitamin A may be a limiting factor in reproduction and calf development of beef cattle.

An experiment was initiated in which four groups of Hereford cows received four different levels of carotene intake during three successive winter hay feeding periods. The present paper presents the response of Hereford calves from cows on the aforementioned regimes. Data on carotene and vitamin A concentrations in blood plasma and livers of cows are to be published.

EXPERIMENTAL PROCEDURE

This experiment involved four groups of cows on winter rations which provided daily carotene intakes of 1.5, 5, 15 and 25 mg. per 100 pounds of body weight. Sixteen mature Hereford cows were selected from the Station herd in 1952 and assigned randomly to the four rations. Those cows remained on the same ration during the subsequent three winter feeding periods with the exception of a few necessary replacements (twelve cows remained in the test group throughout the three years).

All cows were fed individually and received a basic ration of bleached native flood-meadow hay, ad libitum, and three pounds of barley daily. The hay was bleached by leaving in the swath at haying time for three to six weeks or until the green color was gone. Carotene supplement was provided by weighing carrot oil into the barley. The carrot oil was purchased from Barnett Laboratories, Long Beach 5, California, and contained 7.9 mg. carotene per gram of oil.

The forage composition of the hay from native flood meadows was about 90 percent rushes (Juncus spp.) and sedges (Carex spp.) and 10 percent grasses and forbs. The carotene content of the bleached hay was 1.3, 2.4 and 1.5 ppm and the crude protein content was 7.0, 8.0 and 8.1 percent, respectively in 1953, '54 and '55.

The winter experimental feeding periods were initiated in December and terminated in early May each year. Calves from the cows

¹Jointly operated by Agricultural Research Service, U. S. Department of Agriculture and Oregon Agricultural Experiment Station, Oregon State College, Corvallis, Oregon. Technical Paper No. 979, Oregon Agricultural Experiment Station.

on experimental rations received only milk to 28 days of age. The cows and calves were then moved, with the main herd, to the Squaw Butte unit of the Station to graze sagebrush-bunchgrass range. This type of range provides only two to three months of green grass. The main forage producing species, bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis), thurber needlegrass (Stipa thurberiana), June grass (Koeleria cristata) and squirreltail (Sitanion hystrix) are cured out by the first of August.

The management procedure was altered in 1955. In order to investigate rates of depletion of carotene and vitamin A levels of the cows, the cows receiving 1.5 and 5 mg. carotene per 100 pounds body weight were held on their respective rations throughout the summer and fall.

In September all cows and calves were moved to the meadow unit of the Station where they grazed flood meadow aftermath until December.

Cows on a "normal" regime at the Station are fed native flood-meadow hay from November to May, graze sagebrush-bunchgrass range from May to October, and graze meadow aftermath in October and November. New meadow hay of this region has an average carotene content of 45 ppm. It has been found (unpublished data) that hay loses approximately 50 percent of the carotene content the first year and 25 percent the second year.

Calf birth weights and weights at 28 days of age were taken and suggestive symptoms of avitaminosis A were noted. Birth weights of calves from the main herd (field calves) were used for comparison to those of the experimental calves.

Night blindness tests were conducted using the method of Guilbert and Hart (1935) where cows and their calves at twilight were run through a narrow alley containing obstacles. In order to obtain uniform and controlled lighting, covered fifteen watt bulbs were used in the alleyway of a barn. Field calves on adequate carotene rations were tested to ascertain if lighting was too dim. None of the field calves had any difficulty in missing the obstacles.

RESULTS

The average birth weights of calves born to cows on four levels of carotene intake for the three years and those of field calves are presented in Table 1.

Birth weights of experimental calves were not significantly different among treatment groups in any year, and were not different from birth weights of field calves. The cows receiving 1.5 and 5 mg. of carotene per 100 pounds body weight may not have been on their

respective rations long enough prepartum each year to affect birth weights of the offspring.

TABLE 1. AVERAGE BIRTH WEIGHTS OF EXPERIMENTAL AND FIELD CALVES

Experimental Calves					
Cow treatments (mg. carotene/100 lbs. body weight)					Field
Years	1.5	5	15	25	Calves
	lbs.	lbs.	lbs.	lbs.	lbs.
1953	71.5	66.5	70.5	73.0	74.1
1954	75.3	69.3	79.5	69.5	76.1
1955	70.2	67.2	74.7	73.3	70.5
Average	72.3	67.7	74.9	71.9	73.6

Average daily gains of experimental calves from birth to 28 days of age are presented in Table 2.

TABLE 2. AVERAGE DAILY GAIN OF CALVES BORN TO COWS ON FOUR LEVELS OF CAROTENE INTAKE, BIRTH TO 28 DAYS OF AGE

Years	Cow treatments (mg. carotene/100 lbs. body weight)			
	1.5 lbs.	5 lbs.	15 lbs.	25 lbs.
1953	1.70	1.67	1.79	1.74
1954	2.07	2.11	2.04	1.67
1955	1.55	1.77	1.78	1.46
Average	1.77	1.85	1.87	1.62

There were no significant differences among treatments in rate of gain of calves from birth to 28 days of age in any year.

No symptoms indicative of avitaminosis A were observed in any of the calves in 1953 and 1954. In 1955 night blindness developed at an average of 28 days of age in calves from cows receiving 1.5 and 5 mg. of carotene intake throughout the winter feeding period. Calves in the other lots did not show night blindness (Table 3).

TABLE 3. AGE WHEN NIGHT BLINDNESS WAS FIRST OBSERVED AND WEIGHTS OF CALVES AT 28 DAYS OF AGE IN 1955

Cow treatment	Calf No.	Night blindness first observed (da.)	Wt. at 28 days lbs.
1.5 mg. carotene/100 lbs.	B611	34	106
	B522	38	132
	B590	14	101
	B547	29	116
	Average	29	114
5 mg. carotene/100 lbs.	B591	13	82
	B526	26	138
	B527	36	119
	B521	38	128
	Average	28	117
15 mg. carotene/100 lbs.	B565	No night	111
	B545	blindness to	129
	B567	28 days of age	134
	Average		125
25 mg. carotene/100 lbs.	B575	No night	119
	B517	blindness to	120
	B562	28 days of age	104
	Average		114

The weights of calves at 28 days of age were not significantly different among lots in any year. Since night blindness developed in 1955, special consideration is given to calf weights in that year (Table 3).

DISCUSSION AND CONCLUSIONS

Madsen (1942) and Black, et al. (1939) reported that loss of weight is a characteristic of vitamin A deficiency. Eaton, et al. (1951), however, found no significant differences in rate of gain of dairy calves on rations that were adequate and deficient in vitamin A.

Calf weights at 28 days of age in 1955 were not significantly different among lots. The comparatively low 28 day weights of a few calves noted in Table 3 were due to calf scours. Since calves from cows on the 15 and 25 mg. carotene levels developed scours but not night blindness, it would be unlikely that a deficiency of vitamin A would be a causative factor.

Calves B590, B591 and B611, born in April, manifested night blindness early in May. Vitamin A deficiency could be a factor in the reduced gains of these three calves. Additional carotene becomes available to cows under the usual cattle management regimes of this area when new growth of the flood meadows begins and when cattle are turned out to the sagebrush-bunchgrass range in April.

It is recognized that the cows involved in this investigation might not have been on their respective rations for a long enough period to show effects of calf production, but two points should be emphasized. 1. The experimental hay feeding periods coincide with the hay feeding periods practiced in this area when deficiencies would most likely occur. 2. The carotene content of the experimental hay was very low and atypical of the average meadow hay fed.

Cattle consuming average meadow hay (in age and quality) would generally have a carotene intake from 2 to 7 times the National Research Council's recommended allowances for beef cattle.

This study, a study of carotene values of hays and a study of blood and liver values of range cows and calves indicate that the occurrence of vitamin A deficiency in cows and calves of this area is highly improbable on ranches where haying practices and cattle management are reasonably good.

SUMMARY

Calf responses from cows on four levels of carotene intake during the winter hay feeding periods of 1953, '54 and '55 are reported. Response of calves was measured in terms of calf birth weights and gains to 28 days of age.

Birth weights of calves and calf gains to 28 days of age were not significantly different among treatments in any year and were not different from weights of field calves. Night blindness symptoms developed in 1955 in calves only when their dams had been on rations providing carotene intakes of 5 mg. or less per 100 pounds body weight throughout the winter feeding period. Gains of calves which developed night blindness were not significantly different from those of calves with no impairment of visual acuity.

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