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**BRIEF COMMUNICATION**

**Effect of dietary vitamin A on plasma carotenoid concentration and fat colour in cattle**

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**ABSTRACT**

In two trials using cattle grazing green pasture, daily supplements of 1x10⁶ IU vitamin A decreased plasma carotenoid (PC) concentration by 43-58% over 28-31 days. Neither increasing the dose of vitamin A to 2.5 x 10⁶ IU nor continuing the supplement for 83 days further reduced PC concentrations. These decreases in PC concentrations were not accompanied by decreases in carotenoid concentration in the subcutaneous fat or fat colour. This was possibly because PC concentration was still too high to allow a loss of carotenoids from the fat depots.

**Keywords:** vitamin A; plasma carotenoids; fat colour; cattle.

**INTRODUCTION**

Cattle in New Zealand graze green pastures containing high concentrations of carotenoids over most of the year. Accumulation of these carotenoids in the fat of cattle causes it to be yellow in colour, and can result in rejection of the beef in the Japanese market (Yang et al., 1992). Early work by Deuel et al., (1942) indicated that supplements of shark oil and crude extracts of vitamin A could reduce the carotenoid concentration in milkfat and plasma. These workers suggested the vitamin A increased the catabolism of absorbed carotenoids.

The aims of the two experiments presented here were to determine the effects of daily vitamin A supplements on carotenoid concentrations in plasma, liver and fat, and on fat colour in cattle grazing green pasture.

**MATERIALS AND METHODS**

Experiment 1 Thirteen, 2-year-old Angus x Friesian steers at AgResearch Flock House were randomized into two groups (day 0). The groups were grazed in adjacent paddocks with 7 control steers each receiving a daily supplement of 0.5 kg of lucerne pellets containing no vitamin A, and 6 treatment steers receiving 0.5 kg of lucerne pellets containing 1x10⁶ IU vitamin A (retinyl acetate; LutavitÆ A 500 Plus, BASF Germany). Blood samples were collected once a week. After 83 days of supplementation the steers were slaughtered. Liver and subcutaneous fat samples were collected for the measurements of liver retinol concentration and fat carotenoid concentration and colour.

Experiment 2 Twenty, 2-year-old Angus crossbred heifers were randomized into three groups on day 0. The 10 control heifers each received 1 kg of pellets but containing either 1 x 10⁶ IU or 2.5 x 10⁶ IU vitamin A. Blood samples were collected every 3-7 days. The supplements continued for 31 days and then the heifers were slaughtered. Liver samples were collected for the measurements of retinol and carotenoid concentrations.

Analyses of carotenoid concentrations in plasma, liver and fat samples; and the objective measurement of fat colour using a Minolta chromameter, and the calculation of c* values (chroma) have been described by Knight et al., (1994, 1996). The c* values increase as the intensity of the yellow colour of the fat increases.

Data were analysed using GLM procedures (SAS Institute Inc 1987). Repeated measures analysis was used to analyse plasma carotenoid (PC) concentrations, with values on the day treatments started being used as covariates. Analyses of variances were used to compare other traits.

**RESULTS**

Experiment 1 PC concentration for the steers receiving vitamin A decreased (P<0.01) linearly over the 28 days after the start of vitamin A supplementation (Fig 1). Thereafter the PC concentration of steers supplemented with vitamin A were 43-52% lower (P<0.001) than control steers. Despite the difference in PC concentration, there were no differences in subcutaneous fat carotenoid concentration or fat colour (Table 1). Liver retinol concentration in steers receiving vitamin A was 120% higher (P<0.01) than in control steers.

Experiment 2 PC concentration decreased linearly (P<0.001) for heifers receiving vitamin A but there was no difference in the rate of decrease between the two doses of vitamin A (Fig 2). After 31 days, PC concentration in heifers receiving vitamin A was 53-58% lower than control heifers. Vitamin A increased liver retinol (P<0.001) and decreased liver carotenoid (P<0.05) concentrations (Table 2). There was no dose effect of vitamin A on the liver
carotenoid concentration, but heifers receiving 2.5 x 10^6 IU vitamin A had a higher (P<0.001) liver retinol concentration than heifers receiving 1 x 10^6 IU vitamin A.

**DISCUSSION**

The daily feeding of 1 x 10^6 IU vitamin A decreased plasma and liver carotenoid concentrations by 43-58% over 30 days. Continuing the daily supplementation for 83 days or feeding a higher dose of IU vitamin A failed to further reduce PC concentration. Deuel et al., (1942) found 0.7 x 10^6 IU vitamin A per day reduced carotenoid concentrations in milk and plasma, but increasing the dose 2-6 fold caused only small additional reductions in carotenoid concentrations. In contrast, they found a dose response effect of vitamin A on milk carotenoid concentration at lower vitamin A intakes.

Despite the effect of vitamin A on plasma and liver carotenoid concentrations there were no decreases in the carotenoid concentration or colour of the subcutaneous fat. This may be because PC concentration was still too high at 6-7 µg/ml to allow a net loss of carotenoids from the fat depots. Decreasing the PC concentration to 1-2 µg/ml in feedlot steers was accompanied by decreases in the carotenoid concentration in the fat and the yellow colour of the fat (Knight et al., 1996). This suggest there is a minimum threshold of PC concentration which must be reached before fat carotenoid concentrations are reduced.

**REFERENCES**


