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INFLUENCE OF FEEDING MANAGEMENT SYSTEMS ON VEAL PERFORMANCE AND MEAT COLOUR: USE OF EDTA TO CONTROL THE BIOAVAILABILITY OF IRON

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INTRODUCTION

The quality of meat from veal is usually associated with colour. Pale veal produced from exclusively milk-fed animals has been the industry standard for years throughout the world. However, economic as well as animal welfare considerations has given rise to the production of grain-fed veal which has taken a certain share of the market at least in eastern Canada. Meat produced from this feeding system is darker and product colour is inconsistent due presumably to a variable amount of iron in the diet. This study was designed to evaluate the effect of feeding different proportions of concentrates to veal and to assess the feasibility of using a chelating agent to control the availability of iron. The ultimate goal is not necessarily to produce veal meat as pale as the one produced by milk-fed veal but to produce a product which is intermediate in colour and most of all which is consistent in colour.

MATERIALS AND METHODS

Sixty-six male Holstein veal calves were allotted to five experimental groups. Calves in group M were exclusively fed a commercial milk replacer (MR). Calves in group G received MR until weaning and from week two to slaughter, a corn grain-based diet (17.5% C.P., 80ppm Fe) *ad lib*. Calves in group MG, received MR (as in group G plus 750g DM per day of MR after week four) plus the corn diet *ad lib*. Calves in group G+EDTA and group MG+EDTA were fed as their respective controls plus EDTA (15mg/mg Fe from the corn diet) starting at week four of the trial. Feed consumption was measured daily and animals were weighed every two weeks to determine average daily gain (ADG) and at the same time a blood sample was taken for haemoglobin (Hb) determination. Animals were slaughtered at a fixed weight targeted at 184kg for M group, 196kg for MG group and 200kg for G group in order to get similar carcass weights across groups. Carcasses were dressed hide on and graded at 48 hours at which time loin samples were taken to determine loin colour using Hunter L, a, b scale, myoglobin concentration (Warriss, 1979) and muscle iron content.

RESULTS AND DISCUSSION

Animals started on test at approximately 49kg live weight and the targeted slaughter weights were as predicted. Veal from M group were slaughtered at a significantly lower weight than other groups (Table 1). This resulted in similar carcass weights due to the higher carcass yield of M veal. Milk fed veal had a higher dressing percent due to the smaller proportion of the gut and presumably smaller gut content itself. Constant carcass weights were desirable for carcass compositional determinations which will be reported elsewhere. Feeding milk resulted in a similar ADG compared to animals receiving grain based diets. Feeding EDTA to MG animals did not significantly reduce ADG however the means are numerically different. Feeding EDTA to G animals resulted in a significantly reduced ADG and may reflect an initially observed problem with this group although we cannot document it. As expected feed efficiency was much better in M group and feeding of EDTA did not affect this variable significantly. Veal from MG group had a better feed efficiency than veal from G group.

Haemoglobin concentration at slaughter reflects iron availability in the diet and was significantly affected by treatments (Table 2). Concentrations of Hb in veal from M group were not different than Hb concentrations from MG+EDTA and G+EDTA groups. In addition, feeding of EDTA resulted in a significant reduction in Hb of groups receiving concentrates (MG or G groups compared to their respective controls). The colour of the meat from EDTA-fed groups was paler than their respective controls and most probably reflects iron availability. In addition, meat colour from EDTA-fed groups was not significantly different from meat from M group. This suggests that the use of EDTA can help produce veal meat which can be as pale as milk-fed veal. The myoglobin concentration in the meat itself supported colour determinations and also demonstrated that EDTA treated calves produce meat of similar pigment content as meat from milk-fed veal, at least within the boundaries of this trial. The determination of iron in the muscle also followed the same trend as colour or myoglobin. Muscle iron concentration of milk-fed veal was similar to muscle iron concentration of EDTA-fed veal. In addition, EDTA-fed veal produced meat with an iron content significantly lower than their respective controls. Meat colour results from this trial support a previous experiment where exclusively grain-fed veal calves were fed two levels of Ca-EDTA (30 and 60mg/mg of dietary iron) for two time periods (four weeks and eight weeks) prior to slaughter at 20 weeks of age (Pommier *et al.*, 1992). It also documents the slight but significant effect on performance of the previous assay. The use of EDTA had been tried with success with veal fed MR for which 73% of the protein came from fish (Paruelle *et al.*, 1974) and also for veal fed MR for which 71% of the protein came from yeast (Paruelle *et al.*, 1975). The ratio of EDTA to iron was excessively high and was in the order of 175:1. Surprisingly no negative effect on animal performance was reported in either study, but it must be taken into account that total ingested EDTA was about twofold higher in these studies due to much lower concentration of iron in the diet and also due to lower feed intake of the animals.

CONCLUSION

This work demonstrates the feasibility of using a metal chelator to control iron availability for calves. It is important to underline the fact that the concentrations used were high enough to improve the colour of veal and make it comparable to that obtained with milk-fed veal. However this may not necessarily be the goal pursued. A slight reduction in calf performance showed that care must be taken in using such a potent product. In a previous trial (Pommier *et al.*, 1992), EDTA slightly affected performance but the product was given at a much higher dose for a shorter time period. In this trial the concentration was reduced but the animals started to receive the EDTA early during the growth phase in order to block any storage of iron; the procedure was undoubtedly successful. The dosage should be adjusted to insure an adequate supply of iron to produce meat colour of an intermediate intensity between that observed between milk-fed and grain-fed veal found in this study. With this in mind, it would be feasible to adjust iron availability in a concentrate supply to improve the consistency of meat colour in grain fed veal.

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Table 1. Effect of diets on veal performance.

Variable	Treatment Milk	Milk	Mix + EDTA	Grain	Grain+ EDTA	SEM[1]
Start wt, kg	49.3	48.9	48.9	49.0	49.7	0.6
Slaughter wt, kg	183.3	195.3	195.1	197.0	196.8	1.7
Carcass yield, %	68.5	63.4	62.9	62.6	61.8	0.45
Aver. daily gain, kg/d	1.39	1.35	1.26	1.34	1.18	0.04
Feed efficiency kg feed/kg gain	1.64	2.26	2.35	2.70	2.77	0.06

Variable	Contrast[2] 2vs3	4vs5	2vs4	1vs3+5
Start wt, kg	NS	NS	NS	NS
Slaughter wt, kg	NS	NS	NS	*
Carcass yield, %	NS	NS	NS	*
Aver. daily gain, kg/d	NS	*	NS	*
Feed efficiency kg feed/kg gain	NS	NS	*	*

[1] SEM = standard error of the mean.

[2] Contrasts: 2vs4 = mix vs mix + EDTA
4vs5 = grain vs grain + EDTA
2vs4 = mix vs grain
1vs3+5 = milk vs mix + grain

NS = not significant (P>0.10).

* = Significant at P<0.01.

Table 2. Effect of diet on haemoglobin and meat characteristics.

Variable	Milk	Milk	Treatment Mix + EDTA	Grain	Grain+ EDTA	SEM[1]
Hb, g/dl	8.34	10.95	8.07	11.09	7.60	0.31
Colour L loin	36.5	30.6	37.1	30.2	36.9	0.8
Myoglobin, mg/g fresh	1.01	1.56	0.96	1.58	0.92	0.07
Iron content µg/g DM	26.8	38.8	26.6	41.7	28.1	1.7

Variable	Contrast[2] 2vs3	4vs5	2vs4	1vs3+5
Hb, g/dl	*	*	NS	NS
Colour L loin	*	*	NS	NS
Myoglobin, mg/g fresh	*	*	NS	NS
Iron content µg/g DM	*	*	NS	NS

[1] SEM = standard error of the mean.
[2] Contrasts: 2vs4 = mix vs mix + EDTA
4vs5 = grain vs grain + EDTA
2vs4 = mix vs grain
1vs3+5 = milk vs mix + grain

NS = not significant (P>0.10).
* = Significant at P<0.01.