The effects of anabolic agents on aspects of carcass value in cattle

A.V. FISHER AND J.D. WOOD

AFRC Meat Research Institute, Langford, Bristol, BS18 7DY, UK

Introduction

Traditionally, most male cattle are castrated within a few weeks of birth in the United Kingdom and other major beef-producing countries. The reasons for this are improved ease of management and beliefs that the meat produced is of a superior quality. However, this practice is detrimental to the growth potential of cattle, there being ample evidence that growth rate, and particularly lean tissue growth rate, is suppressed (Brannang, 1966).

Synthetic means of improving the growth performance of cattle have therefore been sought, and rumen-active antibiotic feed additives and subcutaneous implants of anabolic agents have been developed by several pharmaceutical companies. In general, anabolic agents have been shown to produce the bigger response, and over 50% of unbred cattle slaughtered in the United Kingdom are implanted with one or more of three main substances (oestradiol 17-β, trenbolone acetate, and zeranol). Their use has been extended to cull cows, and there is current interest in their effects in bulls. This management practice may have extensive economic implications for the producer, but there is little information on the changes in carcass composition, yield and meat quality which are important economic factors for the abattoir owner, wholesaler and retailer. This study examined the effects on these traits of a twice-implanted combined androgenic/oestrogenic compound in cattle twins.

Material and Methods

Cattle twins were purchased directly from farms at approximately 10 d of age, mainly in the South-West region of England. Monozygotic twins were preferentially selected, but dizygotic twins were also included if they were well matched for size and conformation at the time of purchase. Final assessment of zygocity was based on both phenotypic resemblance and a blood test for red-cell mosaicism which identifies a large proportion of dizygotic twins (Brannang and Rendel, 1958). In total, 0.48 of the twins were monozygotic.

The animals were mainly Friesian-type or Hereford x Friesian, and three comparisons were made within pairs:

(i) bull (B1)/castrate (C) (7 pairs)
(ii) bull (B2)/implanted castrate (IC) (9 pairs)
(iii) bull (B3)/implanted bull (IB) (5 pairs)

Effects of implantation were assessed from within-comparison differences. The implant used in (ii) and (iii) was Revalor (Hoechst, UK Ltd) which contained 140 mg trenbolone acetate + 20 mg oestradiol. Animals were implanted at approximately 80 and 300 d of age at the base of the left ear. A complete pelleted diet (11.3 MJME/kgDM) containing 30% chopped straw was fed *ad-libitum* from 90 days of age to slaughter at 400 days. One side of each carcass was fully dissected using the method of Williams and Bergstrom (1980).

Results and Discussion

Live weight at slaughter, feed conversion ratio and carcass composition are given in Table 1.

The significantly greater live weight, and hence greater growth rate, of the bull compared with the castrate was reduced when the castrate was implanted. Implanting the bull produced a small and non-significant increase in live weight, in contrast to some other results using the same compounds in young bulls (Grandadam, Scheid, Jobard, Dreux and Boisson, 1975). There were no differences in feed conversion ratio within any of the three comparisons.

Bulls had a significantly greater proportion of lean in the carcass than castrates, and less fat. Implanted castrates had a similar proportion of lean as untreated castrates, but were heavier. The implication is that untreated castrates, taken to the same weight as the implanted castrates, would probably be fatter, and implantation thus promotes muscle growth at the expense of fat. Implanted bulls had significantly greater proportions of subcutaneous and intermuscular fat in the carcass than untreated bulls, which is in agreement with the reported effects of diethylstilboestrol (Galbraith and Topps, 1981) and zeranol (Greathouse, Hunt, Dikeman, Corah, Kastner and Kropf, 1983).

The absolute weight (kg) of lean tissue produced as a result of the different treatments is given in Table 2, together with the amount in the co-twin relative to the amount in the control bull in each comparison.

By making the assumption that the weight of lean in the body at the beginning of the complete diet feeding period was a constant proportion of body weight (the factor [1/3] was used, Callow [1944]), the conversion of feed into lean tissue was calculated. This ratio (kg DM intake/kg lean) was significantly different in comparisons (i) and (ii), with values of (B1) 22.7, (C) 27.0 ($p<0.01$), and (B2) 23.3, (IC) 26.6 ($p<0.001$) respectively. Efficiency of lean growth was therefore greater in the bull compared with the steer, but implanting the steer tended to reduce this difference, viz. the sex difference in FCR lean was 30% greater in comparison (i) than comparison (ii).

The ratio of lean to bone in the carcass is important, mainly because it reflects the proportion of saleable meat at the same level of fatness. Again, there were significant differences in this ratio in comparisons (i) and (ii), with value of (B1) 4.00, S/C 3.74 ($p < 0.01$), and (B2) 4.12, (IC) 3.95 ($p < 0.05$) respectively. The implanted castrate differed less from the bull than the untreated castrate. It is questionable whether the variation in lean to bone ratio within a breed is detectable in conformation differences. However, improvement in conformation in bulls implanted with zeranol has been reported by Kirk and Cooper (1983), and there have been reports in the literature of improvements in indirect indices of conformation (e.g. M. longissimus depths) when steers are implanted (Rumsey, Tyrrell, Dinius, Moe and Cross, 1981).

The chemical composition (proportions of protein, lipid and water) of the lean tissue for the differently treated animals is shown in Table 3.

There was a greater tendency of the implanted castrate to approach the bull values for chemical composition, when compared with the untreated castrate (and untreated and treated castrate were very similar in terms of proportionate carcass composition). But, in general, the differences were small, and reflected the amount of fatty tissue deposited throughout the body during growth.

Conclusions

Trenbolone acetate + oestradiol 17-β increase growth rate, carcass leanness, and the efficiency of lean growth in steers. Lean to bone ratio is also increased, and the lean tissue contains a reduced proportion of lipid and more protein. However, in all these respects, the implanted steer exhibits values which are intermediate between those of untreated steers and bulls, but the bull values are not emulated. Implanting bulls with the same compounds has little effect on growth rate or carcass characteristics other than fatness, which was marginally increased.

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Table 1. Live weight, feed conversion ratio and carcass composition

Comparison		Live weight at slaughter (kg)	Feed conversion ratio	g/kg carcass Lean	Subcutaneous fat	Intermuscular fat	Bone
(i)	Bull	409	7.9	657	61	117	165
	Castrate	379*	8.3	601***	94**	144**	161
(ii)	Bull	417	8.1	654	65	122	159
	Implanted castrate	413	8.4	605***	97***	145***	153*
(iii)	Bull	416	8.2	660	52	116	171
	Implanted bull	426	8.4	645	64*	127*	165

Table 2. Weight of lean tissue in carcass: absolute values (kg) and % control bull value within each comparison

Comparison		Lean tissue wt.	Relative %
(i)	Bull	135.8**	100**
	Castrate	114.2	84
(ii)	Bull	140.4**	100**
	Implanted castrate	128.8	92
(iii)	Bull	143.0	100
	Implanted bull	139.2	97

Table 3. Proportions of protein, lipid and water in the lean tissue

Comparison		% protein	% lipid	% water
(i)	Bull	21.7**	2.5*	74.3
	Castrate	20.7	4.3	73.4
(ii)	Bull	20.9	2.8***	74.6
	Implanted castrate	20.4	3.7	74.5
(iii)	Bull	20.8	2.6	75.0
	Implanted bull	20.7	2.7	74.8