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Bull performance and carcass and meat quality affected by an oestradiol-17β implant and/or virginiamycin

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Introduction

Anabolic agents are more frequently used in steers than in bulls because they respond better (Galbraith and Topps, 1981). Moreover, steers are preferred by the meat industry, because their hide is thinner and easier to remove (Seideman et al., 1982). Nevertheless beef production in Western Europe, except in the British Isles, is largely dependent on bull fattening (Boucqué et al., 1986). Recently, there is an increased interest to use anabolics in order to increase bull beef production efficiency ; moreover they may reduce hide skinning and hide curing problems (Unruh et al., 1986). Further, the agressive behaviour of bulls was depressed when bulls were implanted with zeranol (Unruh et al., 1986).
Besides hormones, antibiotics are often used to improve animal performances (Fiems et al., 1984). Virginiamycin is already used in pig fattening, but in-vitro results of Van Nevel et al. (1984) suggest that this compound may improve performances of beef cattle. The objectives of the present experiment were to investigate the effect of virginiamycin and an oestratiol-17β silastic rubber ear implant on bull performance and carcass and meat-quality during the finishing period.

Experimental design

Thirty-three Belgian white-red fattening bulls were involved in an experiment to investigate the following treatments : 1) control, 2) 65 mg virginiamycin (Stafac 500®) per kg concentrate, 3) 45 mg-oestradiol-17β in a silastic rubber ear implant (Compudose®) or 4) implant plus virginiamycin. Animals were confined in tie stalls. They received maize silage to appetite, supplemented with 0.75 % concentrate per kg liveweight. The trial lasted 107 days on average and liveweight ranged from c. 500 to about 640 kg. For treatment 3 and 4, animals were implanted at the start of the trial. Virginiamycin was already fed for 196 days. Animals were slaughtered without removal of the implant.
Effect of treatments on growth rate, carcass parameters and meat quality was studied.

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Carcass quality was evaluated based on composition (8th-rib dissection) (Verbeke and Van de Voorde, 1978), dressing percent and blockiness (Van de Voorde and Verbeke, 1979). Meat quality parameters were pH, colour, tenderness, determined following Boccard et al. (1981) and water-holding capacity (Grau and Hamm, 1956). Procedures for analyses of moisture, fat, protein and total collagen content in meat were given by Boccard et al. (1981).

Results and discussion

The effect of implant and antibiotic supplementation on liveweight and daily gain is presented in table 1.

Table 1. Effect of an oestradiol-17β implant and/or virginiamycin supplementation on liveweight and growth rate (kg) ($\pm s_{\bar{x}}$)

	Control	Virginiamycin	Oestradiol	Oestradiol + Virginiamycin
Number of bulls	8	9	8	8
Initial weight	511.1 ± 11.6	496.1 ± 10.5	502.9 ± 5.7	508.3 ± 15.4
Final weight	643.9 ± 14.5	637.7 ± 12.9	638.0 ± 10.8	642.3 ± 18.7
Experimental days	105.6	110.0	104.3	110.0
Daily gain	1.26 ± 0.06	1.29 ± 0.06	1.30 ± 0.06	1.22 ± 0.12

Virginiamycin supplementation and oestradiol implant slightly improved growth rate, while it was depressed by the combination of these treatments. Nevertheless, differences were not significant ($P > 0.05$). The absence of a cumulative effect on liveweight gain by a combined treatment with antibiotics and anabolics, was also established by Boucqué et al. (1986). In experiments of Gill et al. (1983) oestradiol-17β increased weight gain during a 112 day period by 11 % ($P < 0.05$). A faster growth rate ($P < 0.01$) for oestradiol-17β was also reported by Newland et al. (1984). In this trial the effect of oestradiol-17β on gain amounted to 3 % and was similar with the results in a trial of O'Lamhna and Roche (1984). Daily gain of oestradiol implanted bulls was comparable with the growth rate obtained with a combination of progesteron and oestradiol (Boucqué et al., 1986).
The slaughter data and the carcass quality for the 4 treatments are shown in table 2. In comparison with non implanted animals, oestradiol-17β increased the fasting weight loss. Virginiamycin reduced weight losses as well in non implanted as in implanted bulls. However, none of the values differed significantly. Virginiamycin and oestradiol-17β slightly improved dressing

percent, but only dressing percentage of the combined treatment was significantly higher than in the control group. No difference in dressing percent was reported for compudose by Gill et al. (1983).

Table 2. Slaughter data and carcass quality ($\pm s_{\bar{x}}$)

	Control	Virginiamycin	Oestradiol	Oestradiol + Virginiamycin
Number of bulls	8	9	8	8
Slaughter weight (kg)	631.6 ± 14.7	626.0 ± 12.9	622.0 ± 11.8	627.9 ± 18.0
Weight loss after 20 h fasting (%)	1.91 ± 0.22	1.83 ± 0.19	2.51 ± 0.31	2.23 ± 0.23
Dressing percent	60.6^{a} ± 0.5	61.1^{ab} ± 0.5	61.9^{ab} ± 0.4	62.2^{b} ± 0.05
Carcass composition (%)				
- meat	62.6 ± 0.7	63.1 ± 0.9	63.7 ± 1.1	62.2 ± 1.2
- fat	23.1 ± 0.6	22.8 ± 1.0	21.8 ± 1.3	23.7 ± 1.2
- bone	14.3 ± 0.4	14.1 ± 0.3	14.5 ± 0.3	14.1 ± 0.3
Carcass blockiness (kg/cm)	2.81 ± 0.06	2.82 ± 0.06	2.80 ± 0.04	2.88 ± 0.08
EUROP-classification				
E	0	0	0	1
U	1	2	2	1
R	4	4	3	3
O	3	3	3	3

a,b : values without or with the same superscripts are not significantly different ($P > 0.05$)

There was a tendency for an increased meat content in the carcass for virginiamycin and oestradiol. However when both were combined the content was somewhat lower than for control animals. Carcass composition and also carcass blockiness were not significantly affected by any of the treatments. Bulls implanted with trenbolone acetate and oestradiol-17 β (Fisher et al., 1986) or with zeranol (Unruh et al., 1986) had no improved dressing percent. While anabolic agents had mostly no effect on carcass quality, Unruh et al. (1986) reported a reduced hide weight. Fisher et al. (1986) mentioned a tendency for a smaller head in implanted bulls.
The effect of the different treatments on the meat quality parameters is given in table 3. Data of colour were similar for the different treatments. The waterholding capacity ranged between 3.4 and 4.0 cm^2 and did not differ significantly. This is confirmed by about the same moisture content in the meat. The tenderness of the cooked meat was not affected by any of the treatments. This is in agreement with the observed collagen content in the tissue of the Longissimus dorsi. Finally, the ether extract and the protein content were also similar.

Table 3. Meat quality characteristics[a] ($\pm s_{\bar{x}}$)

	Control	Virginiamycin	Oestradiol	Oestradiol + Virginiamycin
Number of bulls	8	8	8	8
pH ultimate	5.50 ± 0.02	5.50 ± 0.02	5.52 ± 0.03	5.48 ± 0.02
Colour				
- Göfo (reflection)	83.3 ± 2.6	85.8 ± 1.3	84.8 ± 1.6	85.6 ± 1.4
- Lab-Scan* : L* value	40.5 ± 0.6	40.4 ± 1.1	37.8 ± 1.2	37.2 ± 1.5
a* value	17.0 ± 0.8	16.6 ± 0.7	18.2 ± 1.3	17.8 ± 1.3
b* value	14.6 ± 0.8	15.1 ± 0.6	15.6 ± 0.7	14.9 ± 1.2
Waterholding capacity (cm^2)	3.9 ± 0.2	3.7 ± 0.4	3.4 ± 0.4	3.8 ± 0.5
Tenderness (kg)	4.2 ± 0.6	4.0 ± 0.4	4.1 ± 0.5	3.7 ± 0.1
Tissue composition (%)				
dry matter	29.6 ± 1.0	28.9 ± 0.8	28.9 ± 0.6	29.2 ± 0.6
protein	22.8 ± 0.3	23.7 ± 0.3	23.4 ± 0.3	23.4 ± 0.2
ether extract	4.2 ± 0.6	3.1 ± 0.4	2.9 ± 0.2	3.3 ± 0.4
collagen	0.83 ± 0.05	0.77 ± 0.02	0.76 ± 0.06	0.80 ± 0.05

a : no significant differences ($P > 0.05$)
* : measured on Lab-Scan II in CIE lab/10°/D65

These results are in accordance with the findings of Calkins et al. (1986), where no effects on tenderness, juiciness carcass lipid and collagen content were mentioned for oestradiol implanted bulls. On the other hand, bulls implanted with zeranol had higher ether extract percentages in the carcass (Calkins et al., 1986 ; Unruh et al., 1986). No reports dealing with the effect of virginiamycin on meat quality of beef cattle were found in the literature.
From these experiments it can be concluded that virginiamycin, oestradiol-17 β implant or virginiamycin combined with oestradiol had no significant effect on growth rate, carcass and meat quality, except that dressing percent was higher ($P > 0.05$) when virginiamycin was combined with oestradiol. Nevertheless, it can be worthwhile to investigate the effect on behaviour and on the head and hide weight at slaughter. The effect of androgenic and oestrogenic combinations on finishing bulls needs further research.

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TABLE 3

Statistics parameters obtained from multiple regresion analysis for the prediction of carcass evaporative weight loss from different combinations of measurements.

Predictors	R^2	F value
Carcass weight	0.07	11.46
Carcass weight + pH45	0.37	0.02
Carcass weight + pH45 + pH24	0.59	4.75
Carcass weight + pH45 + pH24 + Ham temp.45	1.66	0.04
Carcass weight + pH45 + pH24 + Ham temp.45 + Ham temp.24	14.17	40.54
Carcass weight + pH45 + pH24 + Ham temp.45 + Ham temp.24 + Time between weighings	19.62	41.78
Carcass weight + pH45 + pH24 + Ham temp.45 + Ham temp.24 + Time between weighings + fat thickness.	21.22	10.54

TABLE 4

Analysis of variance with carcass evaporative weight loss as dependent variable, carcass measurements as covariables and conveyerised tunnel temperature (TT), conveyerised tunnel relative humidity (HT) and chill room temperature (RT) as main effects.

	F value	Signification
Covariables	26.9	***
Backfat Thickness(mm)	3.8	NS
Time between weighings(h)	45.3	***
Ham temperature 24 (ºC)	12.3	**
Ham temperature 45 (ºC)	0.0	NS
M.longissimus pH24	3.8	NS
Main effects:	25.7	***
Tunnel temperature (ºC)	39.9	***
Chill room relative humidity (%)	16.5	***
Chill room temperature (ºC)	3.4	**

TABLE 5

Multiple classification anlysis grouping the main effects into categories expressing carcass evaporative weight loss mean value for each category as the desviation from its overall mean without adjusting (ETA) and adjusted to the covariables (BETA).

	Categories	ETA	BETA
A	1(-10.5)		
	2(-10.5 to -13.0)	0.18	0.16
	3(-13.0)	-0.27	-0.24
B	1(83 to 75)	-0.19	-0.09
	2(83)	0.15	0.07
C	1(-4.5 to -1.0)	0.10	0.07
	2(-1.0 to 0.0)	0.20	-0.05
	3(0.0 to 3.5)	-0.10	-0.03

A (Tunnel temperature (ºC)
B (Tunnel relative humidity (%)
C (Chill room temperature (ºC)