

EATING QUALITY OF MEAT FROM YOUNG BULLS OF DIFFERENT AGES AND FED IN THREE DIFFERENT FEEDING SYSTEMS

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Introduction

In Denmark, most beef comes from culled dairy cows. However, the industry wanted to test whether it was possible to produce meat from heavy young bulls as an alternative to meat from dairy cows. Furthermore, meat from the heavy young bulls was compared with meat from the traditional young bulls. The meat quality evaluation focused on eating quality and colour. Three feeding systems were applied to the bulls to test whether more roughage-based rations compared with traditional Danish concentrate feeding would also ensure good eating quality.

Materials and methods

Animals and feeding: 72 Holstein bull calves aged 3 months were purchased from 7 privately owned farms. The calves were randomly allocated to 3 treatment groups. The control treatment group (CON) had ad libitum access to a concentrate ration (1.00 Scand. Feed Units (SFU)/kg), while the two other treatment groups (TMR) had ad libitum access to a maize silage-based ration (0.33 SFU/kg) from the start of the experiment until they reached the age of 10½ months. Then, one group changed to a barley-maize silage-based ration (TMR+) with high energy content (0.57 SFU/kg) while the other group continued on the low energy ration (TMR-). Animals were housed in boxes with deep-litter based on straw and had free access to water and barley straw.

Slaughter and ageing: 8 young bulls from each treatment group were slaughtered at the age of 12 months (traditional young bulls), and 16 heavy bulls from each treatment group were slaughtered at a weight of 585 kg (age ranging from 14 to 20 months; mean age: 16 month). Two days after slaughter, the longissimus dorsi (LD) muscles were removed and vacuum packed. The LD muscles from 23 dairy cows (mean age: 53 months, mean slaughter weight: 299 kg) were bought from a slaughterhouse (vacuum packed 3 days after slaughter). All carcasses were cooled slowly (temperature in longissimus dorsi > 10 °C 12 hours after slaughter). The LD were aged for 14 days at 4 °C.

Sensory analysis: Beef steaks (22 mm thick) were cooked to an internal temperature of 62 °C on a preheated frying pan (160 °C). Steaks were cut and served in pieces of 2½ cm x 3 cm and evaluated by 5 trained assessors.

Colour: Steaks were also analysed for colour (L*, a* and b* values) with Datacolour Dataflash 2000.

Intramuscular fat (IMF): Method: Tecator/soxtec. Principle: The fat content (double determinations) was determined by a gravimetric method according to SBR (Schmid-Bodzinski-Ratzlaff, NMKL No 131, 1989). Boiling with hydrochloric acid was used to break down the sample. After the sample had been dried, the fat was extracted with diethyl ether.

Statistics: Data were analysed statistically using an analysis of variance model (proc MIXED, SAS version 8).

Results and discussion

Age at slaughter was 476, 515 and 483 days for CON, TMR- and TMR+ respectively for the “16-month-old” heavy young bulls and 351 days for the 12-month-old traditional young bulls.

IMF: Feeding had no effect on the IMF %, but the IMF % increased with increasing age (12 months: 1.3%, 16 months: 2.1% and 53 months: 4.2%). Thus, consumers who are conscious of low fat content can be sure to get very lean meat when buying meat from 12-month-old young bulls (0.6-2% fat).

Colour: Feeding had no effect on meat colour, whereas the age of the animal did have an effect. The red colour (a*) was highest for meat from dairy cows (20.5) and nearly identical in 12- and 16-month-old bulls (19.0 and

19.4, respectively). Meat from 12-month-old bulls had the lightest colour (L^* : 38.2). Meat from 16-month-old bulls and dairy cows was nearly identical with respect to lightness (33.2 and 32.1, respectively). As to the yellow colour (b^*), meat from 16-month-old bulls was more like meat from dairy cows (9.1 vs. 9.3) than meat from 12-month-old bulls (10.4). In general the colour of the meat from 16-month-old bulls was more like that of meat from dairy cows than that of meat from 12-month-old bulls.

Eating quality: Although tenderness was rated good in all categories, the feeding system affected the tenderness. For 12-month-old bulls CON feeding resulted in less tender steaks (8.9 points) compared with TMR+ and TMR- feeding (10.5 points and 10.2 points respectively). For the 16-month-old bulls, CON feeding resulted in the most tender meat (9.8 points) and TMR+ feeding in the least tender steaks (9.1 points). Feeding had no effect on juiciness, however, but steaks from dairy cows were juicier than steaks from bulls (whether 12 or 16 months old). Meat flavour increased with increasing age (8.5 points to 9.7 points). The degree of doneness decreased as the animal grew older (9.1, 7.7, and 5.8 points, respectively), with steaks from 12-month-old bulls having a much more well done appearance than steaks from dairy cows even though all the meat was cooked to the same internal temperature.

Table 1. Mean IMF (%), sensory score (tenderness, juiciness, meat flavour and doneness) (unstructured line scale, anchored to the extremes; 0 point=slight, 15 points=intense) and colour (Dataflash) of the LD muscle.

Animal age group	Feeding	n ¹	IMF (%)	Sensory analysis (point)				Colour		
				Tender-ness	Juici-ness	Meat flavour	Done-ness	L^*	a^*	b^*
Bulls aged 12 months	TMR-	7	1.3	10.2 ^a	9.2	8.6	9.0	38.4	19.1	10.4
	TMR+	8	1.3	10.5 ^a	8.6	8.4	9.3	38.3	19.6	10.6
	CON	8	1.3	8.9 ^b	8.7	8.5	8.9	38.0	18.9	10.3
Mean		23	1.3 ^c	9.9	8.8 ^b	8.5 ^c	9.1	38.2 ^a	19.2 ^a	10.4 ^a
Sign. Feeding			ns	*	ns	ns	ns	ns	ns	ns
SEM ²			0.1	0.4	1.0	0.9	0.6	0.4	0.2	0.1
Bulls aged approx. 16 months	TMR-	15	2.1	9.5 ^{ac}	8.8	9.0	7.2	32.9	19.8	9.1
	TMR+	15	1.9	9.1 ^{bc}	9.3	9.1	7.3	33.4	19.7	9.3
	CON	15	2.2	9.8 ^a	9.2	9.1	6.8	33.1	18.7	8.9
Mean		45	2.1 ^b	9.5	9.1 ^b	9.1 ^b	7.1	33.2 ^b	19.4 ^a	9.1 ^b
Sign. Feeding			ns	*	ns	ns	ns	ns	ns	ns
SEM ²			0.1	0.4	0.9	0.8	0.6	0.3	0.2	0.1
Dairy cows		23	4.2 ^a	9.8	9.7 ^a	9.7 ^a	5.8	32.1 ^b	20.5 ^b	9.3 ^b
Sign. the 3 age groups			***	ns	**	***	***	***	**	***

¹n = number of animals (4 animals died before slaughter) ²SEM: standard error of the mean

Mean values within a column having different superscript letters are statistically significantly different ($P < 0.05$).

Conclusion

It is possible to produce meat from heavy young bulls (aged approx. 16 months) of similar live weight (585 kg) with a good eating quality corresponding to meat from 12-month-old young bulls and with a meat colour more like that of meat from dairy cows. The feeding system had a small effect on meat tenderness. For 16-month-old bulls traditional concentrate-based feeding resulted in more tender meat than a total mixed ration (TMR+) based on barley and maize silage. For 12-month-old bulls, concentrate feeding resulted in a less tender meat than TMR+ and TMR-. The IMF % increased with increasing age of the animal group.