MEAT QUALITY OF HEIFERS AS INFLUENCED BY GRAZING, FINISHING FEEDING AND CARCASS SUSPENSION METHOD

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Background

In Sweden, the beef production is depending on the seasons. The summer allows grazing and the winter requires indoor housing and feeding. Swedish beef production is based on forage feeding with or without finishing feeding complemented with grain. In order to maintain biodiversity and an open landscape, a production system including the use of semi-natural grasslands is of great importance. Today, within EU, farmers receive subsidies for the commitment to keep semi-natural grasslands open, which will contribute to maintain beef production in Sweden. This production strategy will possibly give a higher proportion of animals slaughtered directly after the grazing period to avoid a second indoor period, which could affect the meat quality.

Steen and Kilpatrick, (1995) showed that finishing feeding at 80% of *ad libitum* intake gave a higher carcass weight while maintaining a constant carcass fat content. That could be of importance since the interaction between those two parameters is in focus in the specifications from the retailers. The consumer is mostly interested in the sensory parameter of tenderness, although beef palatability also depends on juiciness and flavour (Huffman *et al.*, 1996). The great variation in beef quality can be explained by the fact that tenderness and other quality attributes are highly dependent on breed, gender, age, physical activity and rearing system of the animal (Harper, 1999). Lundesjö *et al*. (2002) diminished the variation in meat quality of beef by the use of Pelvic suspension.

Objectives

The aim of this study was to compare the sensory and technological quality of meat from grazing heifers on different indoor feed intensity and slaughter age. A further objective was to study the effect of pelvic suspension.

Materials and methods

Two groups of heifers, of at least 75% Charolais (n = 41) or Aberdeen Angus (n = 40) breed respectively, were used. The experiment had a factorial design, where two levels of indoor feed intensity and two levels of slaughter age were used. All animals had one indoor period followed by a grazing period. Half of the heifers were slaughtered at 18 months of age directly after grazing, whereas the other heifers were slaughtered at 22 months of age after a second indoor period. During the indoor periods the two groups were divided and subjected to two different feed intensities (low and high). For Charolais the low intensity was *ad libitum* intake of grass/clover silage and the high intensity was *ad libitum* intake of silage combined with 2 kg of mixed grain (65% oat and 35% barley). For Aberdeen Angus the low intensity was 80% of *ad libitum* intake of silage and the high intensity was *ad libitum* intake of silage.

The left side of each carcass was rehung from the pelvic bone, while the right side was left hanging in the Achilles tendon. The whole *M. longissimus dorsi* from both sides was vacuum-packed and aged for 7 days at +4 ^{O}C. The pH-value was measured and samples for intramuscular fat analysis (IMF), sensory evaluation and instrumental tenderness (Warner-Bratzler (WB)) measurements were frozen at –20 ^{O}C. Additional samples for sensory analyses and WB measurements were aged for another 7 days before being frozen. Freezing and cooking losses were calculated from the WB samples. A selected and trained panel performed a descriptive sensory analysis. Statistical evaluation was performed using the Procedure Mixed in SAS (Ver. 8e, SAS Institute Inc., Cary, NC, USA).

Results and discussion

The production results from this experiment have been described elsewhere (Hessle *et al.*, 2004). It has previously been showed that instrumental tenderness is improved in different genders by finishing feeding or by intensive compared with more extensive feeding (Bowling *et al.*, 1977; Bowling *et al.*, 1978; Schroeder *et al.*, 1980; Dubeski *et al.*, 1997; Hoving-Bolink *et al.*, 1999a). There are also studies that show no difference in shear force depending on finishing feeding (Harrison *et al.*, 1978; Bruce *et al.*, 2004). This study indicated no significant improvement in shear force for heifers on finishing feeding but a significant improvement with pelvic suspension (Table 1), which agrees with Lundesjö *et al.* (2002). For Charolais heifers, there was an improvement in instrumental tenderness for pelvic suspended sides at 7 days, but no differences could be seen after additional ageing to 14 days. Angus heifers had an improvement in instrumental tenderness for pelvic suspended sides after 14 days of ageing.

For the Charolais heifers, the high feed intensity had positive effects on tenderness with a 23% decrease in bite resistance and a 14% increase in tenderness compared with less intensive feeding. The high feed intensity also led to lower freezing and cooking losses after 7 days of ageing, but not after 14 days of ageing. The pH value was lower in meat from animals of the high feed intensity. The results agree with Hoving-Bolink *et al.* (1999a) who found that intensive feeding resulted in a better eating quality than less intensive feeding. For the Angus heifers, a significant decrease in stringiness was observed for the high feed intensity ($P = 0.008$) together with a slight decrease in acidity ($P = 0.06$). This could be due to finishing feeding after grazing inducing an overall improvement in meat quality, and the level of feeding would be of less importance. Vestergaard *et al.* (2000) showed that extensively fed young bulls, after a finishing period of 10 weeks, showed higher instrumental tenderness as well as sensory scores for tenderness, taste and juiciness, reaching the level of intensively fed young bulls. In the present study did higher carcass weight and higher scores for carcass conformation did not lead to an economic advantage in comparison with the lower slaughter weight (Hansson and Hessle, 2003).

Suspension method combined with slaughter age significantly affected most traits. For the evaluated sensory traits in meat from both the Charolais and Angus heifers only few traits were improved after postponed slaughter until the age of 22 months (Figure 1 and 2). This is contradictory to Harrison *et al.* (1978), where all sensory traits improved after a longer feeding period. However, in the present study, suspending the carcasses by the pelvic bone at the slaughter age of 18 months gave the best eating quality. No additional improvement in meat quality was found at the higher slaughter age in Achilles suspended carcasses except for a higher marbling score. This confirms the results by Hoving-Bolink *et al.* (1999b), where a significant increase in intramuscular fat content did not result in better sensory characteristics. Generally a high marbling score is believed to improve the flavour and juiciness of beef, as Harrison *et al.* (1978) found for grain fed beef. However, Bruce *et al.* (2004) concluded that pasture-finished beef had the highest overall quality because of increased tenderness and juiciness despite the fact that the pasture-finished beef had a lower intramuscular fat content. Of interest in the present study was the decrease in visible marbling in meat from pelvic suspended heifers when slaughtered at 18 months of age in comparison with Achilles suspended carcasses at the same age. In Angus heifers, this was also accompanied by a slight decrease in fatty taste ($P = 0.07$).

Conclusions

An extended rearing period with finishing feeding and/or high indoor feed intensity will probably lead to an improved sensory quality of meat from heifers. However, the effect of pelvic suspension exceeded the other factors by improving the meat quality of heifers slaughtered directly after grazing to the level of finishing fed heifers. Pelvic suspension can therefore be recommended in order to produce beef with a consistent quality.

Acknowledgements

The authors are grateful for the financial support by the Mistra program FOOD 21.

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Table 1. Carcass and meat quality traits in Charolais and Aberdeen Angus heifers (18 and 22 months) suspended in the Achilles tendon or by the pelvic bone

	Charolais Heifers					Aberdeen Angus Heifers			
	Finishing time, Suspension					Finishing time, Suspension			
Quality trait	18 mo, achilles	18 mo, pelvic	22 mo, achilles	22 mo, pelvic	*P*	18 mo, achilles	18 mo, pelvic	22 mo, achilles	*P*
Carcass weight, kg	256	------	331	------	0.001	199	------	240	0.001
Conformation*	7.3	------	9.0	------	0.001	6.1	------	6.3	n.s.
Fat*	5.9	------	9.9	------	0.001	7.2	------	10.3	0.001
IMF, %	1.7	------	2.4	------	0.001	2.3	------	4.2	0.001
Shear force, 7 d	32.8^{a}	30.2^{bc}	30.8^{ac}	30.1^{ac}	0.075	------	------	------	------
Freez loss, 7 d, %	6.8^{a}	5.8^{b}	9.5^{c}	7.1^{a}	0.001	------	------	------	------
Cook loss, 7 d %	23.4	22.0	23.2	21.9	0.148	------	------	------	------
Shear force, 14 d	38.2	29.6	30.5	32.4	0.256	35.0^{a}	28.1^{bc}	30.4^{ac}	0.065
Freez loss, 14d %	6.3^{ac}	5.6^{bd}	7.0^{a}	6.2^{cd}	0.006	4.6^{a}	3.8^{b}	6.6^{c}	0.001
Cook loss, 14d %	19.0^{a}	19.4^{a}	20.3^{ac}	21.7^{bc}	0.006	18.1	18.0	16.9	0.322

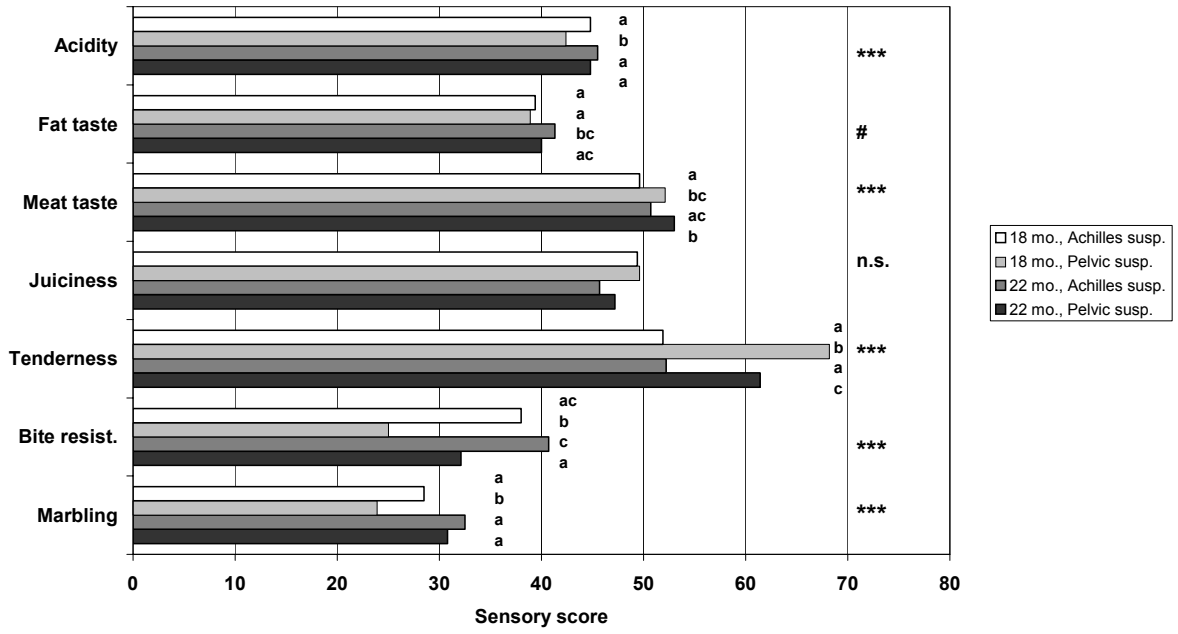

Figure 1. Sensory characteristics in Charolais heifers. Sensory scores within attribute with the same letters are not significantly different (p>0.05). Level of significance: n.s = p > 0.10; # = p≤ 0.10; *** = p≤ 0.001.

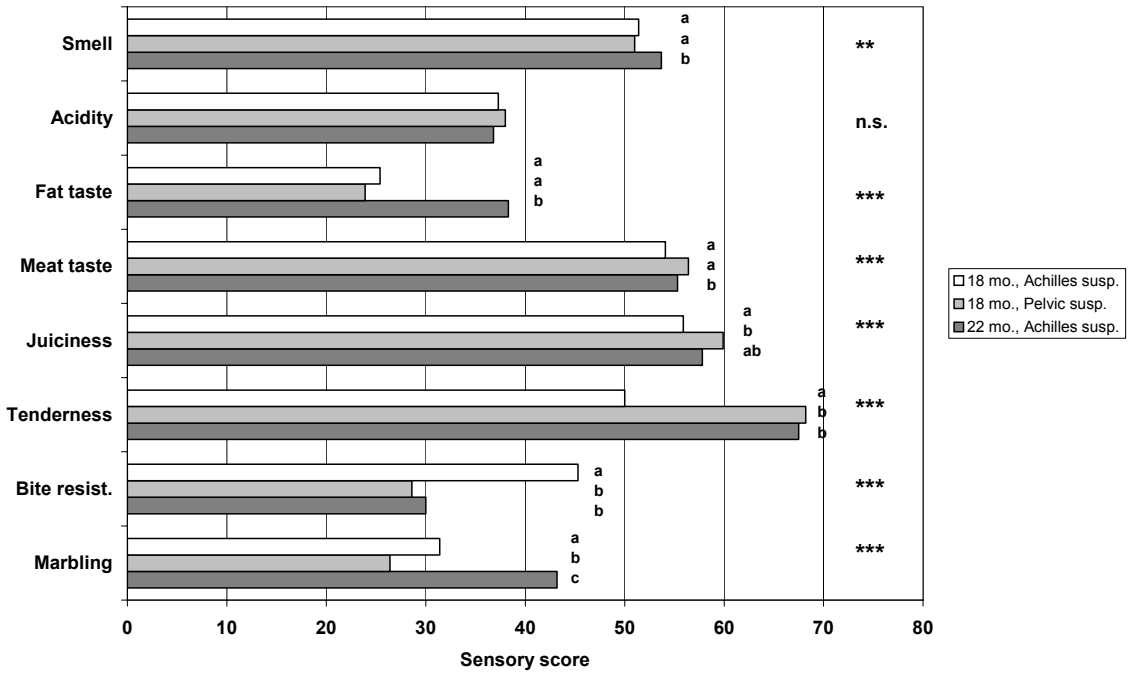

Figure 2. Sensory characteristics in Aberdeen Angus heifers. Sensory scores within attribute with the same letters are not significantly different (p>0.05); Level of significance: n.s = p>0.10; # = p≤0.10; ** = p≤0.01 *** = p≤0.001.