Effect of wet vs. dry ageing on eating quality of beef from traditional breeds

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Abstract

Traditional breeds of British beef animals and commercial crosses were reared on biodiverse or improved pastures. Forty-eight hours after slaughter, the fore-rib joints from one side of the carcass were deboned, vacuum packed and wet aged for a further 19 days, but left on the other side of the carcass and aged on the bone (dry-aged) in the same holding chiller for 19d. Sensory panel assessment consistently showed an improved tenderness and juiciness of fore-loin steaks dry-aged on the bone compared to those wet-aged in vacuum bag. There was no effect on flavour.

Introduction

Consumer research on beef eating quality has shown that the most important attribute in determining acceptability is tenderness, but when tenderness is increased and variability decreased then flavour increases in relative importance (Warkup et al., 1995). Beyond the scientific community many butchers, restaurateurs and chefs believe that dry ageing beef gives a better product, especially for flavour. Whilst dry ageing involves high weight and thus economic loss, US consumers were shown to be willing to pay more for a superior product (Feuz, et al., 2004).

Post farm gate factors are important for flavour variation by changing the concentrations of tissue components, which produce specific flavours in the cooked meat, whilst post-slaughter factors are probably more important for tenderness. Conditioning (ageing) is probably the most important factor. However, both research (Spanier et al., 1997; Jeremiah and Gibson, 2003)) and industry experience is that longer conditioning under some packaging conditions produces 'bland' flavours. Ageing on the bone is thought to produce different flavours from that done in vacuum pack. Jeremiah and Gibson (2003) found that bone-in meat aged in vacuum had higher beef flavour intensity than that aged on the carcass or boned out and aged in vacuum. Campbell et al. (2001) found few significant differences, though dry aging produced more dry-aged flavour, tenderness and juiciness, whilst Warren and Kastner (1992) found consistent positive effects of dry ageing on improving flavour but no difference in tenderness. In a research study into the eating quality of traditional beef breeds reared on biodiverse pastures we were able to compare dry (on the bone) aging with wet (in vacuum bag) aging of beef within the same carcass.

Materials and methods

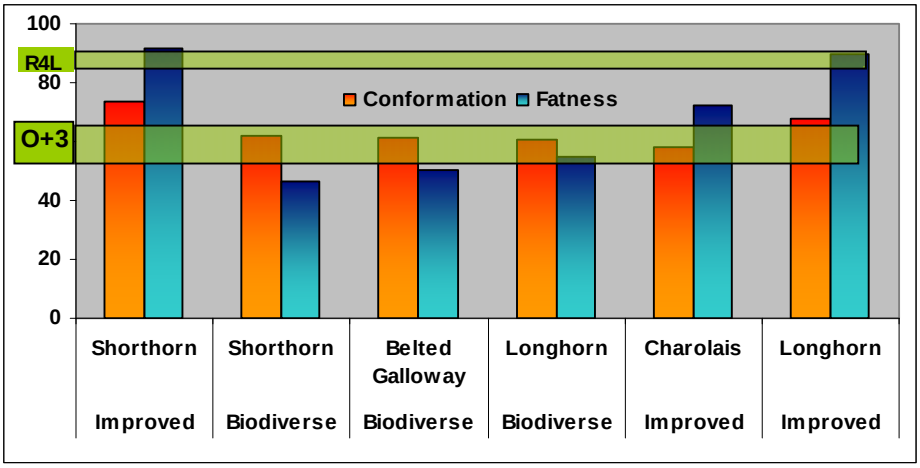
Groups of steers from Traditional breeds were purchased and raised, from approximately 12 months of age, on either pastures rich in herbage species (biodiverse) or improved pastures with few species. They were over-wintered with supplementary conserved forage and then turned out to pasture the following spring. A group of commercial cross animals (Holstein-Friesian x continental) were reared on improved pasture alongside British longhorns representing the traditional breeds. They were slaughtered as they approached 30 months or carcass grade R 3-4L. After slaughter carcasses were held at 12ºC for 10h and then chilled to 1ºC. At 48h post-slaughter carcases were quartered between the 6th and 7th rib. A four rib, fore-rib joint was removed from one side, the meat deboned and placed in a vacuum bag, sealed and stored at 1ºC for 19d (wet aged) in the carcass holding chiller. The hindquarter from the other side of the carcass was held in the same carcass holding chiller for 19d (dry-aged) and then the fore-rib boned and vacuum packed. Both samples were frozen for subsequent sensory analysis.

Fore-loins from commercial animals were bought from a local abattoir that used high voltage electrical stimulation (HVES) and immediate chilling. Meat was boned out, vacuum packed and aged to 21d from slaughter (commercial).

Sensory analysis was carried out by a 10-person trained taste panel (BSI, 1993). The sample was defrosted overnight at 4 ºC, cut into steaks 20mm thick, and grilled to an internal temperature of 74 º C. All fat and connective tissue was trimmed and the muscle cut into blocks 2cm^3, wrapped in pre-labelled foils and placed in a heated incubator. Panelists assessed combinations of breed x ageing type samples in each session using 8-ponit category scales for tenderness, juiciness, beef flavour and abnormal flavour.

Results

Many of the carcasses from the traditional breeds grazing the biodiverse pastures were poorly finished and but less subcutaneous fat than those from improved pastures and the commercial carcasses (Figure 1). On average the loin muscle of the traditional breeds had 1.5% lipid compared to 3% in muscle of commercial animals or those finished on improved pastures. Animals had to be slaughtered before they reached 30 months of age due to BSE regulations in force at that time. This may have affected the sensory ratings.



†Carcasses were graded on the EUROP system which was converted into numerical values for statistical analysis.

Figure 1. Carcass conformation and fatness scores† for carcasses from Traditional breeds and commercial crosses reared on improved or biodiverse pastures.

The results of the sensory panel are shown in Table 1. In part 1a results are given for individual groups of animals. For all the traditional breeds on biodiverse pastures, tenderness and juiciness were greater for the dry aged compared to the wet aged samples. Whilst the Longhorns were not grazing the same biodiverse pasture as the Beef Shorthorns and Belted Galloway, they were panelled on the same day as each other and were given higher ratings for tenderness and juiciness. The Beef Shorthorns reared on improved pastures had better ratings than those raised on a biodiverse pasture. This may be due to the better carcass finish, especially fatness of the animals grazing improved pasture.

In part 1b all the traditional breed data is combined and compared with loins from commercial animals purchased from a local abattoir. It is quite clear that dry aging produces a superior product for the traditional breed carcasses, however, the commercial loins, which had been wet aged, were more tender, but of intermediary juiciness.

In part 1c, carcasses from Longhorns are compared with those from commercial Charolais cross animals which had grazed the same improved pasture. There was no significant difference between wet or dry aging for tenderness and juiciness, but the Longhorns produced better scores. Again this may have been due to their carcasses having a better conformation and finish. There were no differences for flavour.

Discussion

Grazing traditional breeds on biodiverse pastures may be one way to maintain these special pastures, but it is difficult to finish animals within 30 months in such a system without supplemental feeding during the winter period to bring then closer to finishing before they spend a final summer at grass. Despite this they produce carcasses with good eating quality. The data does suggest that the eating quality is improved in animals that are better finished i.e. the Beef Shorthorns from the improved vs. the biodiverse pastures. Longhorns appeared better able to finish and give better eating quality under grazing conditions than other traditional breeds on biodiverse pastures over this time frame and commercial crosses on improved pasture. Dry ageing gave better eating quality in terms of tenderness and juiciness than wet aged samples from the same animals. This is more difficult to explain, but juiciness may have improved by concentration of the fat through the loss of moisture during the dry ageing period (Campbell et al., 2001). Texture may have been increased due to the tension in the muscle produced by being aged on the bone, though improved tenderness has also been seen in striploins dry aged off the bone (Campbell et al., 2001). Whilst dry aging produced more tender and juicy meat than wet aged meat from the same animals, it was not as tender as that from commercial animals which had been electrically stimulated and wet aged. This difference may have been

due to a combination of better finish and the effect of the HVES. It is of note that no combinations of comparison produced differences in flavour, the main effect ascribed to dry aging by traditional butchers.

A more direct comparison should be made between wet and dry aging of carcasses that have or have not been electrically stimulated.

Table 1. Effect of wet and dry aging on sensory characteristics of beef fore-loin steaks

Pasture		Breed	Aging	Tenderness	Juiciness	Beef Flavour	Abnormal Flavour
1a	*Improved*	Shorthorn	Dry	4.78	5.48	5.04	2.73
			Wet	3.84	4.97	5.13	2.58
			p	***	***	ns	ns
	Biodiverse	Shorthorn	Dry	4.20	5.39	4.78	2.91
			Wet	3.30	4.79	4.63	2.89
			p	***	***	ns	ns
	Biodiverse	Belted Galloway	Dry	4.50	5.20	4.80	2.60
			Wet	3.30	4.60	4.40	2.60
			p	***	***	*	ns
	Biodiverse	Longhorn	Dry	5.70	5.60	5.10	2.60
			Wet	4.70	5.00	4.90	2.40
			p	***	***	ns	ns
1b Combined		*Traditional*	Dry	4.72^{b}	5.39^{c}	4.90	2.56
			Wet	3.94^{a}	5.06^{a}	4.84	2.55
		Commercial	Wet	5.10^{c}	5.24^{b}	4.78	2.70
			p	**	***	ns	ns
1c	*Improved*	Charolais	Dry	4.74^{b}	4.83^{bc}	4.79	2.75
			Wet	4.74^{b}	4.69^{c}	4.47	2.70
	Improved	Longhorn	Dry	5.04^{ab}	5.24^{a}	4.79	2.64
			Wet	5.2^{a}	5.10^{ab}	4.79	2.94
			p	**	**	ns	ns

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References

BSI. (1993). Assessors for sensory analysis. Guide to selection, training and monitoring of selected assessors. BSI 7667. *British Standards Institution*, London, UK.

Campbell, R.E., Hunt, M.C., Levis, P. and Chambers, E. (2001) Dry-aging effects on palatability of beef longissimus muscle. Journal of Food Science, 66, 196-199.

Feuz, D.M., Umberger, W.J., Calkins, C.R. and Sitz, B. (2004) US consumers' willingness to pay for flavor and tenderness in steaks as determined with an experimental auction. Journal of Agricultural and Resource Economics, 29, 501-516.

Jeremiah, L.E. and Gibson, L.L. (2003) The effects of postmortem product handling and ageing on beef palatability. *Food Research Internationa*l, 36, 513-520.

Parrish, F.C., Boles, J.A., Rust, R.E. and Olson, D.G. (1991) Dry and wet aging effects on palatability attributes of beef loin and rib steaks from 3 quality grades. Journal of Food Science, 56, 601-603.

Spanier, A.M., Flores, M., McMillin, K.W. and Bidner, T.D. (1997) The effect of postmortem ageing on flavour in Brangus cattle. Correlation of treatment, sensory, instrumental and chemical descriptors. Food Chemistry, 59, 531-538.

Warren, K.E. and Kastner, C.L. (1992) A comparison of dry-aged and vacuum-aged beef strip loins. Journal of Muscle Foods, 3, 151-157.

Warkup, C. Marie, S. and Harrington, G. (1995) Consumer perceptions of texture; the most important quality attribute of meat? In: *Expression of tissue proteinases and regulation of protein degradation as related to meat quality*. Eds A. Ouali, D.I. Demeyer and F.J.M Smulders, ECCEAMST, CIP-Gegevens Koninklijke Bibliotheek Den Haag pp225-238.