

EFFECTS OF PRODUCTION AND CARCASS CHARACTERISTICS ON TENDERNESS (SHEAR FORCE) IN BOVINE YOUNG BULLS

NIELS T. MADSEN and LISE RAMSGAARD JENSEN

Danish Meat Research Institute, PO Box 57, DK-4000 Roskilde, Denmark

Objectives

The primary production of beef in Denmark is from young bulls and cull cows of dual-purpose breeds. Due to high variability in consumer satisfaction with respect to quality a desire to sort and market products according to tenderness prevails.

Objective methods for predicting tenderness is still at the experimental stage. However, experienced people in the industry claim that some indication of final tenderness is detectable from animal and carcass characteristics, such as animal age (A), carcass weight (CW), pH, intramuscular fat content (IMF), conformation (Con) and fatness (Fat) scores.

The objective of this analysis is to evaluate animal and carcass characteristics in relation to a mechanical objective assessment of tenderness, in this case Volodkewich shear force (SF) on aged M. Longissimus dorsi (LD) samples.

Experimental methods

Animals from different feeding and breeding experiments from 1984 to 1993 were pooled to represent normal variation in age and carcass quality. Only Red Danish and Danish Friesian young bulls were represented. Gross daily gain (GDG) and net daily gain (NDG) was registered.

All animals were transported, slaughtered, chilled and measured according to standard procedures, i.e. the animals were slaughtered consecutively shortly after arrival at a commercial abattoir. The carcasses were electrically stimulated with low voltage for approx. 20 seconds after stunning and bleeding. Weight of kidney fat (KF) was registered.

Carcasses were chilled at 12°C for 4 hours, at 5°C for 3 hours and then kept at 3°C. The carcasses were classified for conformation and fat cover according to the EUROP scheme using a scale from 1 to 15 with 15 being the best conformation, and a scale from 1 to 5 for fat cover with 5 for a thick fat cover.

The day after slaughter pH₂₀ in the LD was measured in the chiller before jointing and separation of tissue on the right carcass side were carried out. Dressing percentage (DP), saleable yield (SY) and fat trim (FT) was registered, a sample of the LD was taken from the 12/13 thoracic vertebrae to the 1st lumbar vertebrae for meat quality evaluation according to a method recommended by Boccard et al. (1981). Analysis was not performed in cases where pH₂₀ was above 6.1 which reduced the material by less than 2%.

The samples were vacuum packed and aged until 7 days post mortem at 4°C. On day 7 post mortem the anterior part of the LD muscle was cut: a 6 cm steak for shear force measurement and a 2 cm steak for colour measurement. The remainder of the LD sample was minced for analysis of ultimate pH_{7D} and intramuscular fat content. Samples to measure shear force were vacuum packed and frozen after ageing. The samples were thawed at 5°C, cooked to a final, internal temperature of 72°C and cooled. Strips of meat were cut into sizes of 10 x 20 mm (6 strips per animal) in cross section in a plane perpendicular to the direction of the fibre bundle. The max. force to chew 80 % into the strip was registered with a Volodkewich shear attachment on a Karl Frank 81559. Intramuscular fat was determined by using the Soxtec HT-H*.

Principal results

The range of weight and age shown in table 1 indicates a good representation of the Danish young bull production, however the mean is slightly lower for CW compared to the present production mean of 245 kg. The young bulls with a maximum age of 1,3 years are a lean product with good yields and on average of quite acceptable eating quality with respect to SF as the mean was 6.41 kg. The animals were intensively fed with a high daily gain of 1120g.

With respect to shear force values varied considerably with the maximum values being more than three times as high as the mean. Production or carcass characteristics were not very useful in explaining the variation in SF which is a belief in some part of the industry. IMF and pH values showed the highest correlations with shear force. IMF is generally claimed to be an indicator for good eating quality. With respect to Volodkewich SF quite acceptable levels were achieved below the recommended general minimum of 2% IMF to ensure good quality, which was expectable with young animals.

A slight increment in SF with increasing pH₂₀ is in agreement with the curve linear relationship suggested by Purchas (1990). However due to the procedures no results were available for high pH carcasses.

Environmental factors, such as pre-slaughter treatment, chilling, ageing and cooking procedures influence meat quality to a large extent. In this experiment the influence of these factors were minimized by standard procedures. Thus the prevailing variance is thought to be caused by genetic variation within breeds and proteolytic factors yet to be explained since the variation in collagen and its properties are thought to be of minor importance within the biological and chronological range of the young bulls in this experiment. Linear prediction models were applied to predict SF from animal and carcass parameters but their practical relevance were limited due to high standard errors of prediction, which is selfevident based on the parameters' simple correlations with SF.

Table 1. Means, standard deviations, minimum and maximum values of animal and carcass characteristics and their simple correlations to shear force.

Trait	Obs.	Mean	Std	Minimum	Maximum	Corr. with SF
SF, kg	796	6.41	2.37	2.97	20.57	1.0000
CW, kg	796	215.23	26.15	145.00	322.00	-0.08037
A, days	796	342.30	32.45	221.00	471.00	0.01051
Con, class	796	4.93	1.10	1.00	8.00	0.00081
Fat, class	796	2.45	0.61	1.00	5.00	-0.10250
IMF, %	796	1.83	0.63	0.60	4.81	-0.16125
KF, kg	796	5.07	1.94	1.10	13.80	-0.12880
pH ₂₀	662	5.69	0.14	5.21	6.07	0.21459
pH ₇₀	796	5.48	0.06	5.38	6.30	0.15988
DP, %	796	50.74	1.72	45.03	56.40	-0.05228
SY, %	600	74.83	1.40	71.15	79.18	0.03318
FT, %	633	5.80	1.10	1.67	9.05	-0.13561
GDG, g	796	1120.13	130.95	772.19	1623.62	-0.08262
NDG, g	796	568.75	72.81	372.89	862.30	-0.08900

Conclusion

Production and carcass characteristics are of poor value in prediction of shear force values in Danish young bulls up to 1½ years, given the animal and carcass is handled correctly pre slaughter and post mortem.

References

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