

RELATIONSHIP BETWEEN CATTLE SEX, PRODUCTION AND CARCASS CHARACTERISTICS AND THE INCIDENCE OF DARK CUTTING BEEF

Shahid Mahmood, John A. Basarab, Jennifer L. Aalhus, Graham Plastow and Heather L. Bruce

email: shahid3@ualberta.ca

Carcasses of young cattle having > 2 mm subcutaneous fat and bright red rib eye muscles (m. *longissimus thoracis*) are graded Canada A, AA, AAA or Prime according to intramuscular fat content. Carcasses from young cattle with dark red or purple coloured rib eye muscle are downgraded to Canada B4, the dark cutting grade. Dark cutting is caused by muscles not having sufficient glycogen to fuel post mortem anaerobic glycolysis and reduce muscle pH below 6. The value of dark cutting carcasses is reduced by up to \$1 per kg because muscle colour is unattractive to consumers and prone to microbial growth. Because of the substantial economic penalty, predicting and preventing dark cutting would be financially advantageous for beef producers and abattoirs. This study tested the hypothesis that the likelihood of a beef animal producing a Canada B4 carcass can be predicted using animal sex, growth performance, body weight, muscle size and carcass characteristics.

Materials and Methods

An existing data set containing dry matter intake (DMI), average daily gain (ADG), feed conversion ratio (FCR), residual feed intake (RFI), ultrasound rib eye area (uREA), ultrasound subcutaneous fat depth (uSFD), ultrasound marbling score (uMS), carcass weight (CarWt), grade fat depth (gFD), grade rib eye area (gREA) and grade marbling score (gMS) collected between 2003 to 2011 from 845 steers and heifers from three different farms was used to test the effect of gender on dark cutting. A sub-set of cattle that graded Canada AAA (n =28), AA (n =29), and A (n =15) was also drawn from this data set to relate carcass and animal phenotypic characteristics to the probability of dark cutting or Canada B4. Canada A, AA and AAA cattle selected were matched by lot and date of birth to Canada B4 animals (n = 28).

Statistical Analyses

The effects of gender and farm were analyzed with Statistical Analysis System (SAS Version 9.2, SAS institute Inc., Cary, NC) using the CATMOD procedure. The effects of carcass and animal phenotypic characteristics were tested using Multinomial and Binomial Logistic regression with backward selection including second order interactions among carcass and animal measurements. The effect of grade on RFI was tested by one way analysis of variance using PROC GLM.

Results

The ratio of dark cutting was 3.3% and there was a trend toward carcasses from heifers to cut dark more frequently than those of steers (P=0.11). The predicted probability of a carcass grading Canada B4 or AA increased as carcass weights increased from 200 to 300kg and up to a marbling score of 400 but beyond these values a carcass was most likely to grade Canada AAA (Figure 1).

The modeled probability of Canada B4 carcass increased as REA increased but was lowered as carcass weight increased (Figure 2).

At a mean DMI of 8.2 kg/day and a mean body fat 6.8mm, the predicted probability of an animal grading Canada B4 or A grade increased as uREA increased but the probability of Canada AA and AAA grade gradually declined (Figure 3a).

At a mean uREA of 75 cm and a mean DMI of 8.2 kg/day, the probability of an animal to produce a Canada B4 and AA carcass increased as body fat increased up to 7 mm, above which there was a tendency for Canada AAA grade carcass to be produced (Figure 3b). The likelihood of an animal producing a Canada B4 carcass declined as DMI increased while the probability of Canada AAA and A grade gradually increased at a mean REA and body fat of 75 cm and 6.8 mm, respectively (Figure 3c).

RFI was not significantly different across different grades but mean RFI values were positive for Canada AAA and AA (0.12, 0.067) while negative for cattle that produced Canada

B4 and A grade carcasses (-0.01 and -0.07, respectively).

Conclusions

The cattle most at risk of producing Canada B4 carcasses appeared to be those that also produced Canada AA carcasses. Cattle that produced Canada B4 carcasses had feed intake less than 6kg/day, uREA greater than 80 cm² and back fat less than 7 mm. Low feed or energy intake appeared indicative of animals at risk of dark cutting beef. Potential Canada B4 animals had a specific physical type and these animals could be identified by producers using ultrasound, weigh scales and monitoring of feed intake. Dark cutting in animals at risk can be reduced by providing high energy diet two weeks before slaughtering and minimizing ante-mortem stress by handling with extra care.

References

Jacob et al. (2001). Recent Advances in Animal Nutrition in Australia. 13, 8A.
Martin et al., 2004. Journal of Animal and Feed Science, 13, (Suppl.1), 639-642.
Pethick, D.W., Rowe, J.B. (1996). Australian Journal of Agricultural Research. 47, 525-37

Acknowledgments

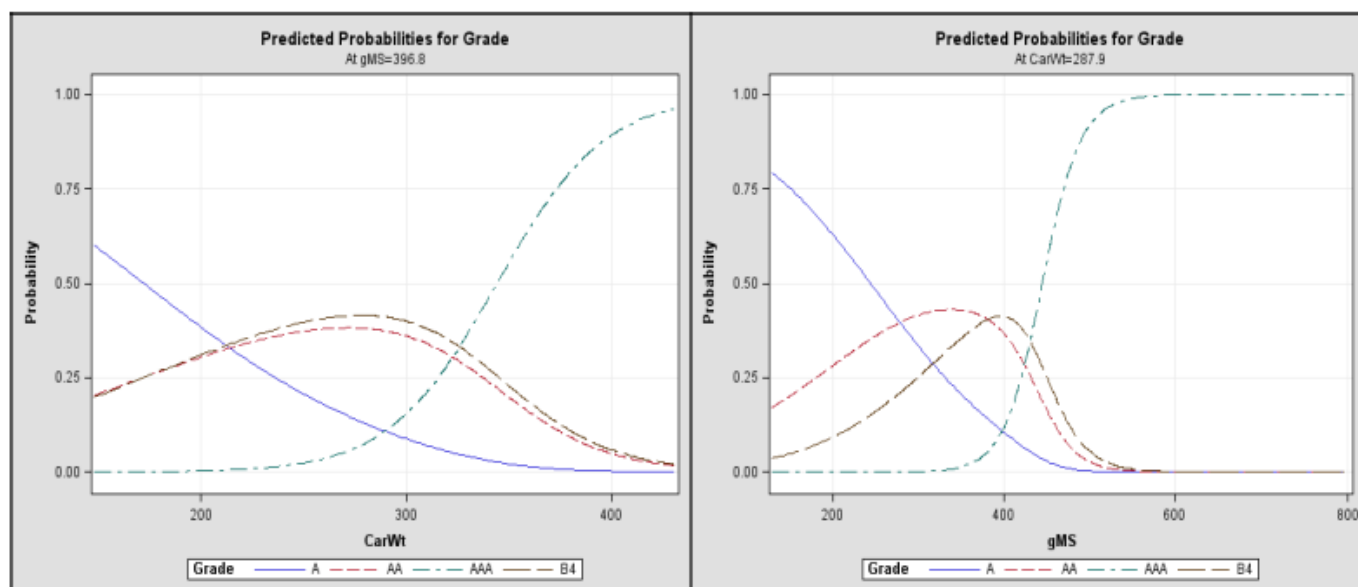


Figure 1. Relationship of predicted probability of carcass grades with carcass weight (CarWt) and marbling (gMS) score

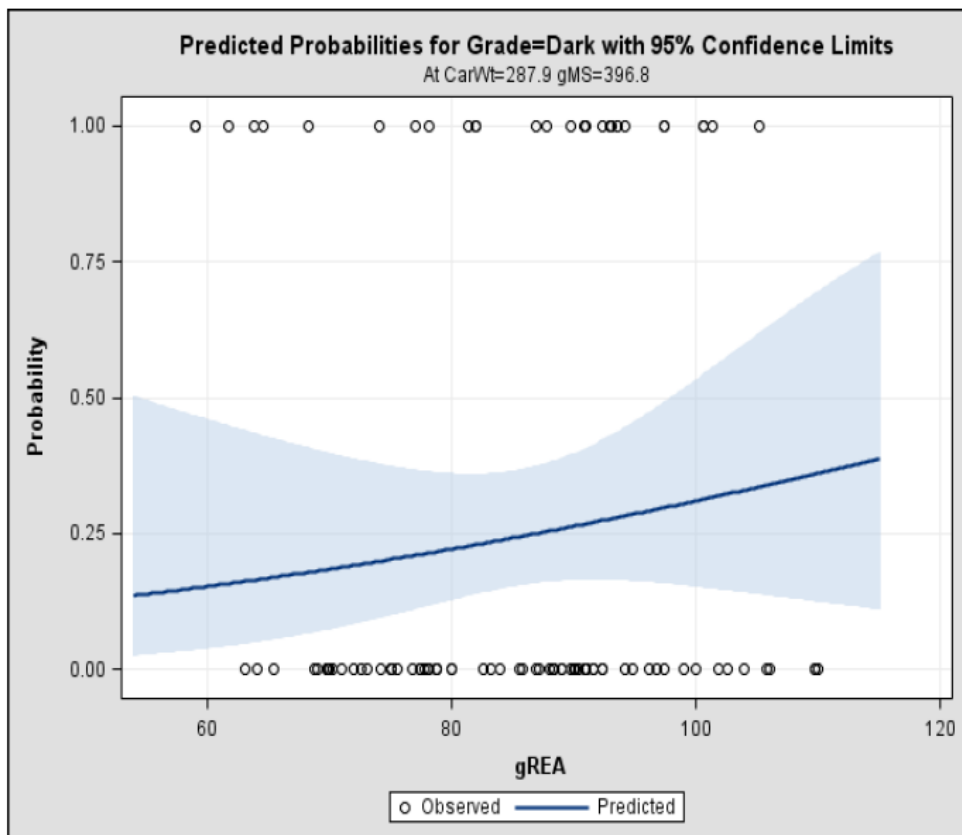
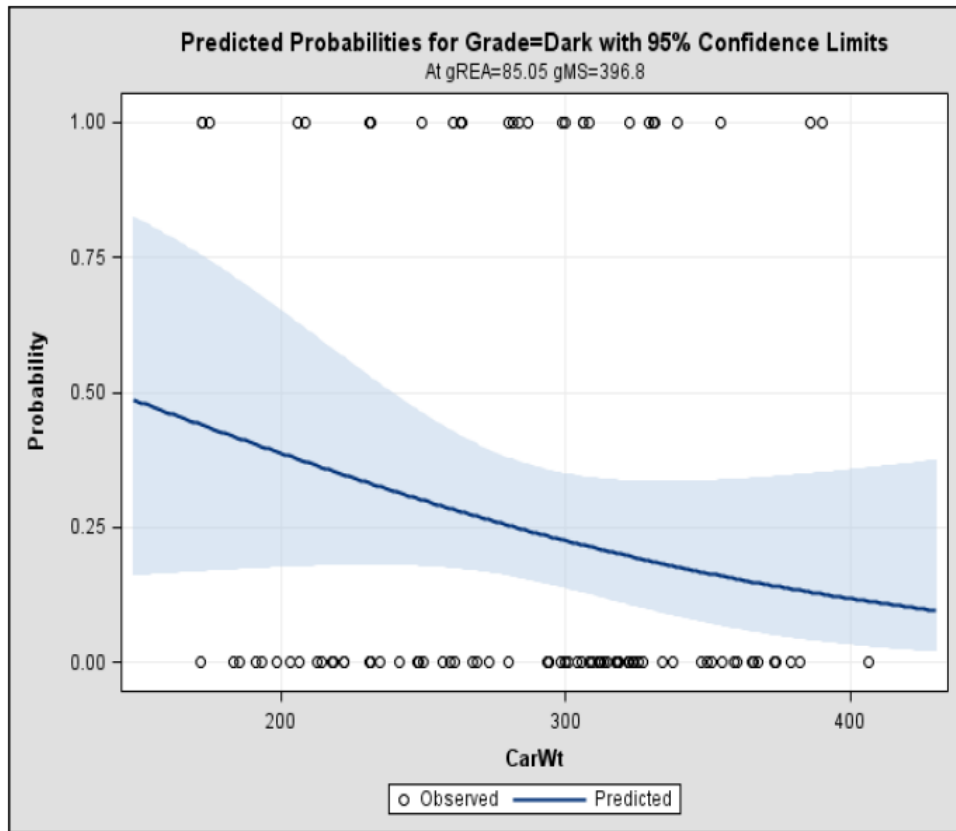


Figure 2. Relationship of predicted probability dark cutting with carcass weight (CarWt) and rib eye area (gREA)

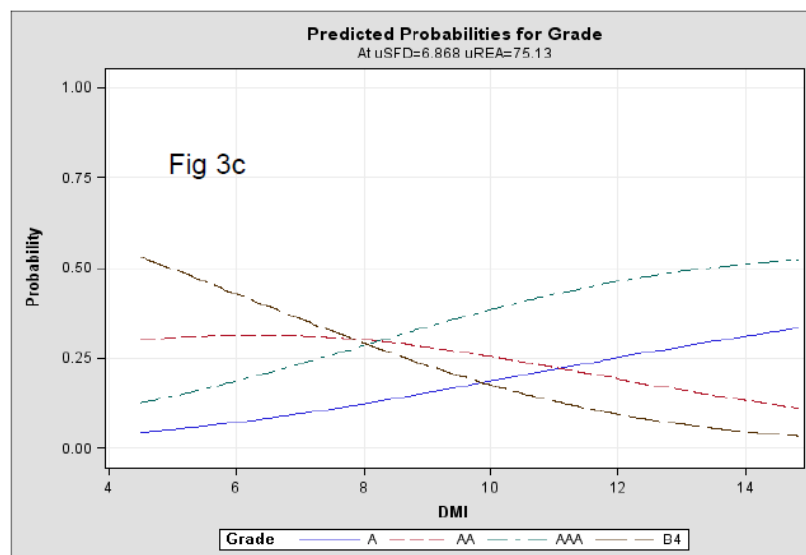
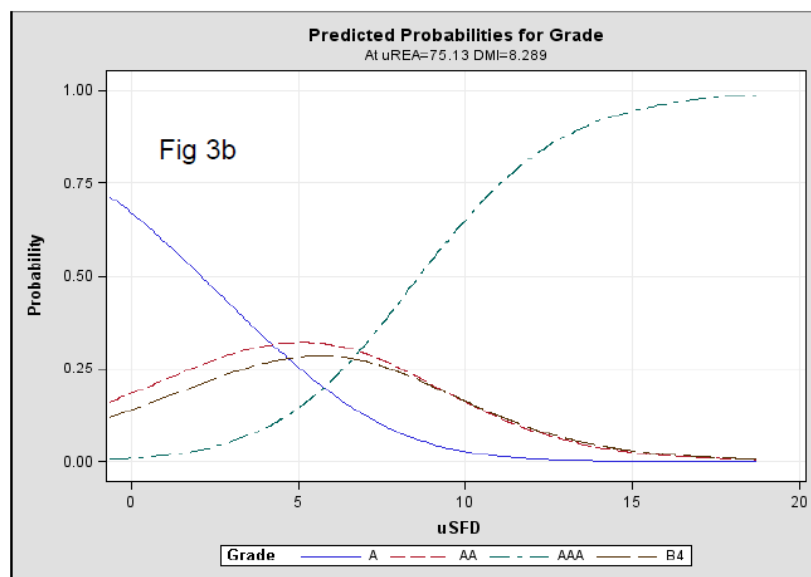
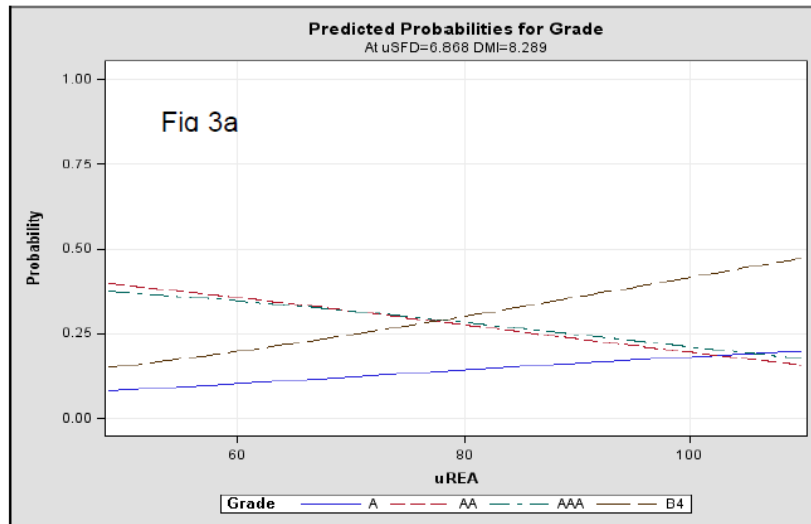


Figure 3 (a,b,c). Relationships of live animal body fat (uSFD), REA (uREA) and DMI with carcass grades