METHODS TO PREDICT THE RETAIL MEAT YIELD OF A BEEF CARCASS

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Introduction

The prediction of the composition of a live animal, as well as the one of its carcass, is a critical point for all the segments of the meat chain (Herring *et al*, 1994). The benefit of a correct and reliable estimation at a producer level could be reflected in a potentially more efficient use of the feed by grading the animals according to their tissue composition, and by defining the market of destination for the meat produced. The main advantages at a slaughter house level, are buying homogenous products and that they present a greater retail product yield (Cannell *et al*., 2002). The objective of this work consisted on including objective measurements to predict the retail product yield of a beef carcass through the development of models using animal variables measured alive and *postmortem.*

Materials and Methods

This paper is based in the results obtained in 2 studies.

Study 1 – Ultrasound measurements in live animals.

Hereford steers (n=120), backgrounded on pastures were finished in 2 feeding systems (feed lot and improved pastures). During the finishing period ultrasound measurements (rib eye area REA and subcutaneous fat SF) were recorded between 12^{th}-13^{th} ribs every 28 days. Also, live weight and hip height were recorded at this time. The average end point and age at slaughter was 450 kg and 26-30 months, respectively. At the packing plant live and hot carcass weight were recorded and after ribbing SF and REA were determined. At fabrication the weight of the pistola sealable cuts were recorded. Simple and multiple linear regression equations (SAS Inst. Inc., Cary, NC) were developed using model selection procedures.

Study 2 - Video Image Analysis (VIA)

Carcasses (n=335) were selected by SF, and carcass weight. Images of individual carcass sides were obtained by the VIA hot before carcass washing. After chilling images with the VIA chilled were taken. Designated sides were ribbed at the $10^{th}/11^{th}$ rib interface. Carcass sides designated for fabrication were then broken into quarters and weighed to obtain a chilled carcass side weight. Quarters were tested for the red cuts of the hindquarter. The total weight recovered from each side was computed. If during fabrication recovery was less than 99.5% or greater than 100.5% data from that carcass was removed from the study. Saleable meat yields were calculated as a percentage of the side gross weight. Simple and multiple linear regression equations were developed using stepwise (α value for entry was set at 0.15 and α value for exit was set at 0.16) model selection procedures.

Results and Discussion

Study 1 - Ultrasound in live animals

This technology has been used in the meat industry to determine the composition of the body of a live animal. The adequate use of this tool allows: to determine final points to slaughter and to estimate the retail product yield. At this point, INIA has been validating the use of this technology and developing models with the inclusion of the alive and carcass weights, the rib eye area (REA) and the thickness of subcutaneous fat (SF). Herring *et al* (1994) found that ultrasound measurements taken previous to slaughter had a high predicting value for carcass composition. In Figure 1 is shown the effectiveness in the prediction of the caliber of the main cuts of the hindquarter using alive or *postmortem* variables. The effectiveness, defined as the percentage of animals or carcasses that give cuts over a defined weight, showed, for this study, that the model including carcass weight and SF was the more accuracy (84%). May *et al* (2000) developed models in which ultrasound measurements explained 57% of the variation in the yield of boneless subprimals followed by live estimates (R^2=0.49) and carcass ultrasound (R^2=0.31), showing that live estimates and live ultrasound SF either singularly or in combination is a viable option for assessing carcass composition before slaughter.

Study 2 - Video Image Analyses (VIA) on the carcass

The VIA systems to predict the percentage of retail cuts of a carcass are based on digital images took of the whole side of a hot carcass or of the cross section of the rib after carcass chilling. In Uruguay, INIA working along with INAC (Meat National Institute, Uruguay), CSU (Colorado State University, USA) and RMS

(Research Management Systems), carried out a study to validate this technology. The main objective was to evaluate the effectiveness of the VIA system on hot carcass (VIA hot) and on chilled carcass (VIA chilled) independently or both combined, compared with the Official current Grading System of Uruguay (INAC), to estimate the retail product yield of beef carcasses (Figure 2). The yield of saleable meat presented in this work was calculated considering a system of red cuts (without fat and connective tissues). The results of this study indicate that the prediction of the retail yield of the beef meat increased when both systems of VIA were used (R^2=0.69). These results are consistent with those reported by Cannell *et al*. (2002) who found that R^2 values improved to 0.64-0.69 by using both VIA hot and chilled systems to predict beef carcass yield. The accuracy of the prediction of the proportion of valuable cuts of a carcass was higher with the use of any of the VIA systems compared with the current Uruguayan Grading System (R^2 =0.57 or 0.59 VIA vs 0.25 INAC).

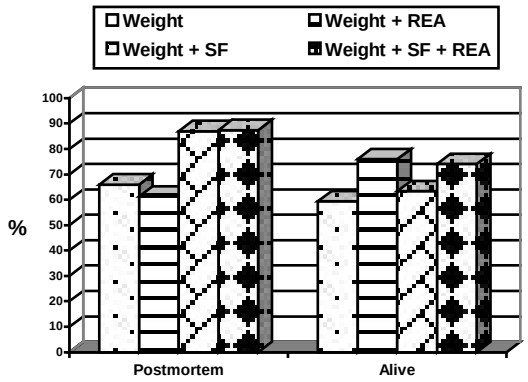

Figure 1. Effectiveness on the prediction of the main cuts of the hindquarter using alive or *postmortem* variables.

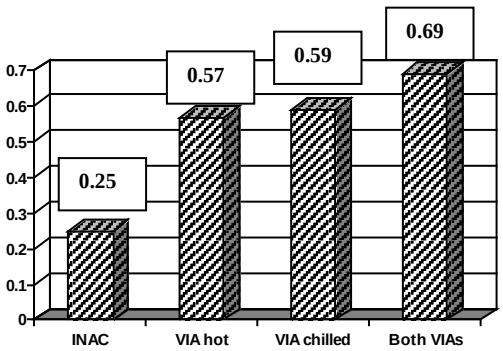

Figure 2. Prediction of the retail product yield using the Uruguayan Official Grading System (INAC) and both video image analysis systems, independently or combined.

Conclusions

The use of these objective measurements of meat characteristics (alive or *postmortem*) will depend on their inclusion in the commercialization systems as well as on the relationship between benefits and costs of the technique. The results of our studies indicate that the prediction models of the retail meat yield (considered as the proportion of valuable cuts of a carcass) of the Uruguayan beef, improve their effectiveness when they incorporate, additionally to the weight, measurements of the REA and fundamentally of the SF. Nevertheless, when the variable to be predicted is the weight (cut weight), live or carcass weight by itself, showed about 60% effectiveness.

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References

1. Cannell, R.C., Belk, K.E., Tatum, J.D., Wise, J.W., Chapman, P.L., Scanga, J.A., and Smith, G.C. (2002). Online evaluation of a commercial video image analysis system (Computer Vision System) to predict beef carcass red meat yield and for augmenting the assignment of USDA yield grades. *Journal of Animal Science*, 80, 1195-1201.
2. Herring, W.O., Williams, S.E., Bertrand, J.K., Benyshek, L.L., and Miller, D.C. 1994. Comparison of live animal and carcass equations predicting percentage of cutability, retail product weight and trimmable fat in beef cattle. *Journal of Animal Science*, 72, 1107-1118.
3. May, S.G., Mies, W.L., Edwards, J.W., Harris, J.J., Morgan, J.B., Garrett, R.P., Williams, F.L., Wise, J.W., Cross, H.R., and Savell, J.W. (2000). Using live estimates and ultrasound measurements to predict beef carcass cutability. *Journal of Animal Science*, 78, 1255-1261.