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Kidney fat as predictor of beef carcass characteristics (#105)

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Introduction

Kidney fat (KF) percentage along with pelvic and heart fat, external fat, rib-eye area and carcass weight are used to determine the yield grade of a beef carcass in the USA (AMSA 2001). In Europe, the grading system entails the estimation by means of conformation (from superior to poor) and quantity of fat cover (from low to very high) through the EUROP score (Regulations (EEC) No. 1208/81 and No. 2930/81). The aim of this study was to compare the ability of KF with fat class as estimators of different beef carcass characteristics: trimmed body fat, total meat and saleable meat yield (SMY).

Methods

A sample of 353 beef carcasses (175 Heifers, 79 Steers and 99 Young Bulls) were selected from a commercial abattoir, over a ten week period, to ensure good variability in terms of breed, EUROP conformation and fat class across the different categories. Kidney fat (KF) weight was recorded during carcass dressing, which was performed according to Commission Regulation (EC) 1249/2008. After chilling (48h, 1°C), the right side of each carcass was quartered and the subsequent bone-out to the same burchery specifications occurred at 72h. Weights of the different primal cuts, lean trims, membrane, bone, and trimmed body fat were recorded during the process. Total meat was computed as the sum of the weight of the different primal cuts (trimmed to a pre-defined commercial specification) plus meat trimmings, while saleable meat yield (SMY) as the percentage of total meat with respect to the carcass weight. Statistical analyses were made using R studio (R Core Team 2018) and the caret package (Kuhn 2008). Predictions were made by means of a k-fold cross validation.

Results

Correlations

Positive and significant correlations were found for KF weight and trimmed body fat for all animals and categories (Figure 1). A moderate correlation was obtained when grouped together ($r=0.58$), but even though significant ($p<0.01$), the correlations were weak ($r<0.5$) when separated in the different categories. Young bulls had the highest correlation ($r=0.47$). If using KF in percentage (of total carcass weight) correlations dropped for all categories and became non-significant for steers and heifers. Nonetheless, when correlating to total meat, KF percentage values showed higher and significant correlations (Figure 2), whereas if using KF weight, the correlations were lower and non-significant for steers and young bulls. Correlations of fat sub-class and trimmed body fat weight were significantly higher for all the categories ($r=0.60$-0.81) when compared to the KF counterparts.

Predictions

All animal categories were pooled together for predictions. With regards to predictors of trimmed body fat weight (kg), fat sub-class was a better predictor ($R^2=0.67$, RMSE=3.16) than KF weight ($R^2=0.35$, RMSE=4.44) and KF percentage ($R^2=0.26$, RMSE=4.76). Conformation sub-class combined with fat sub-class was a better predictor of SMY ($R^2=0.38$, RMSE=2.87) than conformation sub-class with KF percentage ($R^2=0.23$, RMSE=3.21) and conformation sub-class with KF weight ($R^2=0.20$, RMSE=3.27). Compared with fat sub-class, KF percentage was a better predictor of total meat weight when in combination with conformation sub-class ($R^2=0.39$, RMSE=19.30). Whereas, if KF weight was used instead, the explained variance decreased to $R^2=0.23$ (RMSE=22.16). Nonetheless, a combination of conformation sub-class and carcass weight resulted in the best overall prediction ($R^2=0.93$, RMSE=6.31).

Conclusion

KF proved to be correlated to some extent with the trimmed fat from the animal. However, the correlations were much lower than the ones presented by fat sub-class. This difference was also seen in the predictions. Only KF percentage was a better total meat predictor than fat sub-class when in combination with conformation, but weight was the most important predictor for this trait. After considering these results, EUROP conformation, fat class and weight out-performed the prediction power of KF for body fat, total meat weight and SMY.

Acknowledgements

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Literature

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Kuhn, M. (2008). Building Predictive Models in R Using the caret Package. Journal of Statistical Software, 28(5), 1 – 26

R. (Core Team 2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Notes

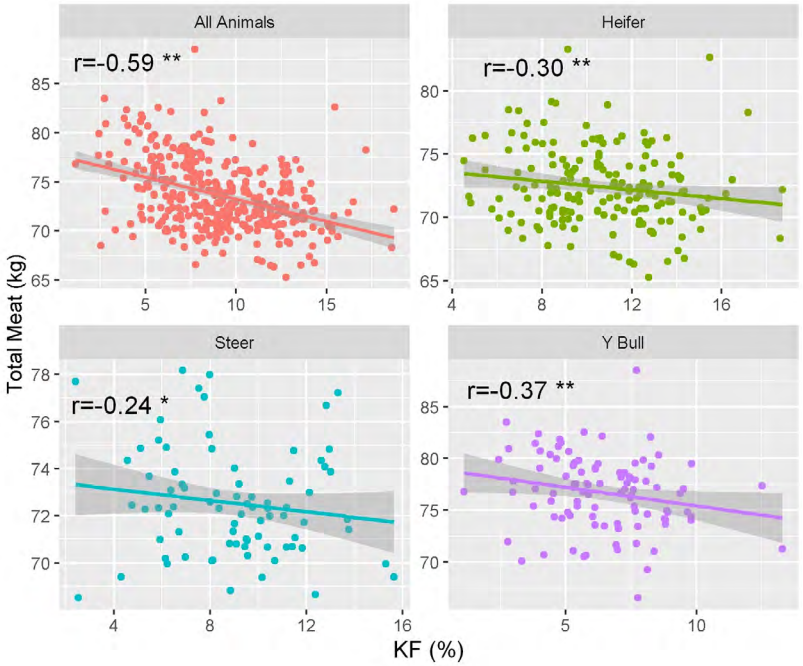

Figure 2. Correlations of Kidney Fat (KF) (%) vs Total Meat (kg)
* statistically significant (P<0.05), ** statistically significant (P<0.01)

Notes

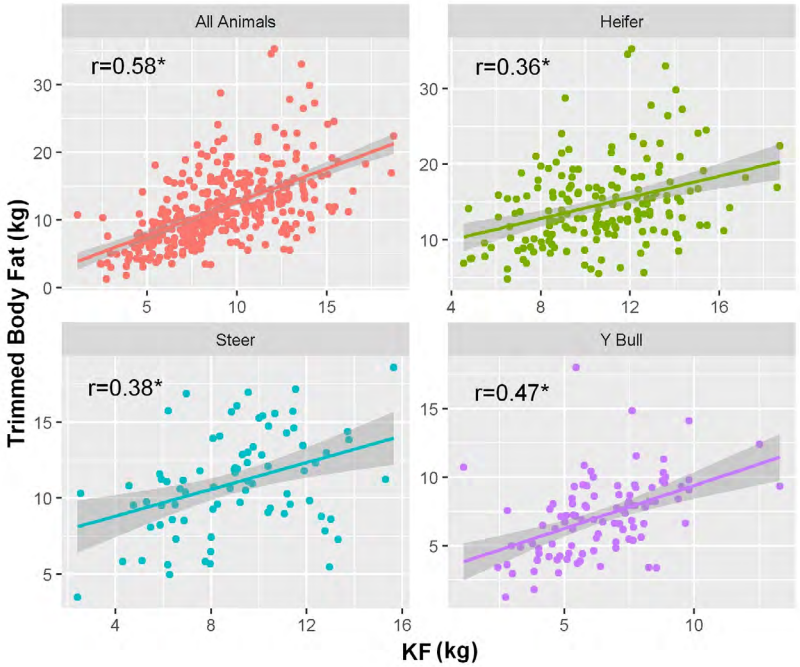

Figure 1. Correlations of Kidney Fat (KF) (kg) vs Trimmed Body Fat (kg)

* statistically significant (P<0.01)

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