

Using Ultrasound Technology To Predict Loin Intramuscular Fat Content In Live Pigs



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Introduction

Pig selection for leaner pork has undoubtedly influenced intramuscular fat (IMF) content and the proportions of lean and fat in the carcass. IMF content has an influence on the eating attributes of pork and on consumer visual preferences (Fortin *et al.* 2005; Ngapo *et al.* 2007). Also, approximately 50% of pork produced in Canada is exported and Asian markets represent more than 45% of the exported meat volumes and cash receipts related to export. Japanese consumers prefer meat cuts with high levels of IMF (including in the loin muscle). It would be interesting to control IMF levels to better meet the demands of domestic and international markets. IMF is a moderately heritable trait. The development of an accurate and practical *in vivo* method to measure intramuscular fat levels could allow for the potential measurement of all selection candidates without requiring slaughter.

Objective

The objective of this study was to evaluate the effectiveness of an image analysis software developed by Biotronics Inc. to accurately predict IMF percentages in loin muscles of live pigs and to include this trait in genetic selection.

Materials and Methods

A group of 150 Duroc pigs were scanned using ultrasound technology and the "captured" images were then submitted for image analysis to estimate the *in vivo* intramuscular fat percentage in the *Longissimus dorsi* muscle of pigs. The ultrasound equipment used was the Aloka 500 SSD and image analysis performed using the Bio-Soft Toolbox for Swine software developed by Biotronics Inc. Eight to ten longitudinal images were collected on each animal. Pigs were scanned at an average live weight of 111 kilograms by technicians accredited for ultrasound measurements on live pigs. Subsequently, the pigs were slaughtered including 82 females, 31 castrates and 37 males. Post-mortem measurements were taken at the slaughterhouse. Visual marbling scores (NPPC, 1999) at the 10th, 11th, 12th and 13th rib, IMF content in the loin determined through chemical analysis as well as collagen content (at 11th and 12th rib) for each extracted loin were performed for each slaughtered animal. All post-mortem measurements were performed on loin extracts from the right side of the carcasses.

Results

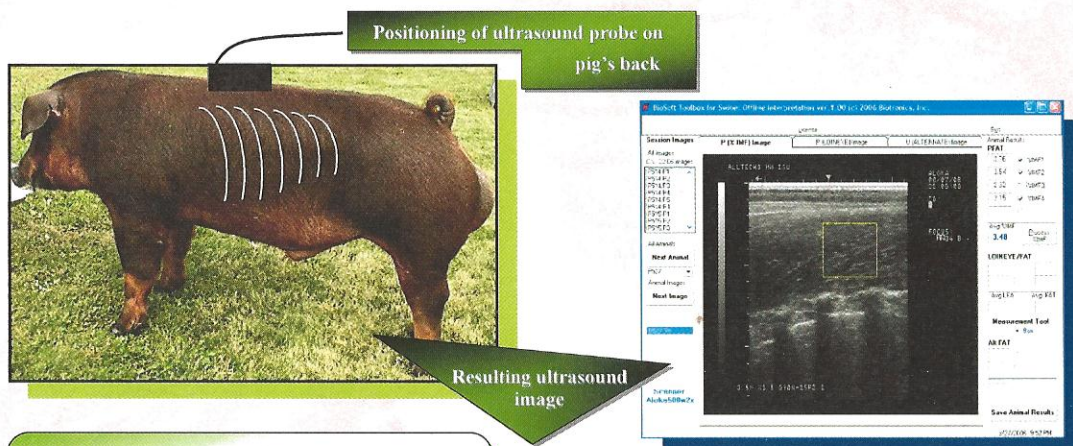


Figure 1. Location of IMF measure in the *Longissimus dorsi* muscle of live pigs and picture of image obtained using ultrasound technology. The probe is placed at 5cm from the median line and covers the area from the 10th to the 13th ribs.

Example ultrasound image used for prediction of intramuscular fat percentage. The yellow square represents the region of interest (ROI), where image analysis is carried out.

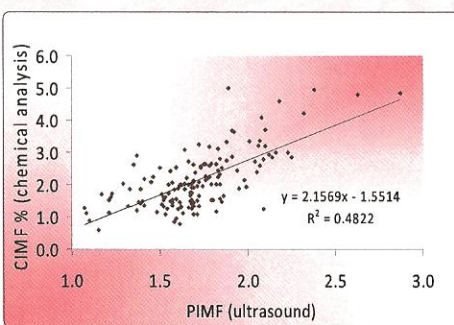


Figure 2. Regression of carcass chemical analysis of intramuscular fat percentage (CIMF) on predicted intramuscular fat percentage in live pig (PIMF).

Table 1. Means of variables measured on the *Longissimus dorsi* muscle and Pearson correlations between predicted live IMF measurements and other variables. (N = 150).

| Variable | Mean | SE | Min. | Max. | Correlation IMF (<i>in vivo</i>) |
|---------------------------|------|------|------|------|------------------------------------|
| IMF (<i>in vivo</i>) | 1.71 | 0.28 | 1.07 | 2.87 | 1.00 |
| Chemical IMF (%) | 2.13 | 0.87 | 0.59 | 5.00 | 0.69 |
| NPPC 9 - 10th ribs (pts) | 2.29 | 0.68 | 1.00 | 5.00 | 0.53 |
| NPPC 10 - 12th ribs (pts) | 2.42 | 0.66 | 1.00 | 5.00 | 0.55 |
| NPPC 12 - 13th ribs (pts) | 2.54 | 0.64 | 1.50 | 5.00 | 0.46 |
| NPPC 13 - 14th ribs (pts) | 2.55 | 0.69 | 1.00 | 5.00 | 0.50 |
| NPPC means (pts) | 2.45 | 0.62 | 1.13 | 5.00 | 0.55 |
| Collagen (mg/g) | 3.93 | 0.64 | 2.30 | 5.54 | -0.21 |

NPPC = National Pork Producer Council marbling standards (1,0 = 1,0% to 6,0 = 6,0% and 10 = 10,0%)
SE = Standard error

Results

The correlations between *in vivo* measures and visual scores for one part and chemical analysis were 0.69 and 0.55, respectively ($P < 0.05$). The standard error of prediction (SEP) of IMF content determined through chemical analysis was 0.71%. The correlation between intramuscular fat *in vivo* measures and the percentage of collagen in the loin was slightly negative (-0.21 , $P < 0.05$) which suggests that the collagen content in muscle is not being interpreted as IMF. The obtained results are very promising and show that the software developed by Biotronics Inc. can efficiently predict the percentage of intramuscular fat in loins and could potentially be used for the selection of candidates for this trait.

Perspectives

The IMF determined using ultrasound technology will be integrated during 2009 as a new trait for selection in the Canadian Swine Improvement Program. Further studies on a greater number of animals are necessary to validate genetic parameters and adjustment factors for sex and weight at slaughter. This technique will also need to be applied to other breeds and possibly also on other cuts of meat such as ham.

Acknowledgements

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References

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