Bellies iodine value evaluated non-destructively with NitFom(TM)

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Introduction and Objective: Belly is an important cut of pig carcasses, which in some countries, is the most valuable cut. Its struc- ture is very complex. One of the main quality parameters is belly firmness, which is related to several factors such as the amount of fat, belly thickness and the degree of unsaturation of the fat, determined, for instance, by its iodine value (IV) (Soladoye et al., 2017). NitFom™ (Frontmatec-Smoerum A/S) is a near infrared transmission (NIT) device designed for use on-line at the slaughter- house to determine the IV of pork fat in the warm carcass (Sørensen et al., 2013). Lam et al. (2022) used the NitFom predicted IV from the shoulder region of the warm carcass to predict the belly bend angle in the cold belly cut with promising results. The aim of the present work is to evaluate the feasibility of using the NitFOM to predict the belly IV and to determine the optimal anatomical position of the belly for probing.

Materials and Methods: A total of 84 bellies from different origins were selected. Cold bellies were measured with NitFom ™ (Frontmatec-Smoerum A/S) and spectrum from 1100 to 1900 nm were collected during the retraction of the twinprobe that penetrate into the belly. Measurements were taken at 6 different positions: 5 positions distributed along the dorsal part of the belly (po- sition 1, at the caudal edge until position 5 at the cranial edge), and 1 position in the central part of the belly. In each position a maximum of 80 spectra were obtained over the 3 cm penetration depth. For each fat tissue spectrum an IV is calculated and the averaged IV across the tissue depth are used as the NitFom predicted IV per belly. A subcutaneous fat sample of the central part of the belly was collected for chemical IV analysis. Later the entire belly was minced, homogenized and chemical IV analysis was also performed. Chemical IV was determined using a modified equation from AOCS (Lo Fiego et al., 2016). Data analysis was carried out using Matlab software (R2018b) and PLS toolbox (8.6.2) from Eigenvector. The preprocessing applied was the standard nor- mal variate (SNV) and the mean centering. Partial least square (PLS) regression was used to find the best prediction equation for IV at the different probing positions. Root mean square error of cross-validation (RMSECV) and cross-validated determination co- efficient (R^2cv) using random split (10 splits and 5 iterations), were obtained to evaluate the goodness of fit.

Results and Discussions: The reference IV of the subcutaneous fat of the central part of the belly was 68.8+4.5% and those from the minced belly was 65.3+5.0%. NitFom IV prediction of belly subcutaneous fat has a RMSECV (R^2cv) of 1.6 (0.89), 1.8 (0.86), 2.1 (0.85), 2.3 (0.78) and 2.3 (0.77) at the 5 dorsal positions, from cranial to caudal part. It was 2.6 (0.67) in the central position of the belly. Thus, although the reference IV was determined in the subcutaneous fat of the central part of the belly, the NitFom prediction is better in the dorsal-cranial region. When the NitFom IV prediction was compared to reference values from the minced belly, the RMSECV (R^2cv) were 1.6 (0.82), 1.8 (0.89), 2.3 (0.85), 2.3 (0.83) and 2.4 (0.78) at the 5 dorsal positions, from cranial to caudal part. And it was 2.4 (0.74) at the central part of the belly. Thus, although the NitFom uses spectral information from the subcutaneous fat and any appearing intermuscular fat, the error of prediction of IV is similar when compared to IV of the minced bellies or only those of the central subcutaneous fat.

Conclusions: Prediction of IV from bellies depend on the position where the measurement is taken. The dorsal cranial part being more accurate than dorsal central-caudal and central part of the belly. Moreover, IV from central subcutaneous fat can be used as a reference avoiding the mincing of the whole cut. Overall, the crossvalidated prediction error was around 2 IV using the NitFom for prediction compared to chemical analysis.

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