COOK, FREEZE, SHEAR – THE QUEST FOR THE BEST SEQUENTIAL ARRANGEMENT

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Abstract – In order to develop a routine method and a standardized protocol for measuring cook loss and shear force as new quality traits in the Swiss pig breeding scheme, the effect of freezing either the fresh or the cooked samples was investigated and compared with results from samples not being frozen at any state. The Correlations of cook loss and shear force of non-frozen samples with samples frozen raw, before cooking, were lower than with samples stored frozen after cooking. These results indicate that the samples should not be frozen before measuring the cook loss, but better be stored frozen in a cooked state before performing the shear force measurement.

Key Words – pork, shear force, cooking loss, pig breeding.

I. INTRODUCTION

Tenderness and cook loss are meat quality traits of high relevance for the consumer. In pork, cook loss and shear force, as an indicator of tenderness, show medium to high heritabilities and considerable variation (Petca et al., 2012). Therefore, these traits can be improved in pigs by means of breeding. Estimation of breeding values as a base for genetic selection requires performance testing of a high number of animals. This consequently requires, at least short term, storage of samples, which cannot all be analyzed in due time. Freezing raw meat samples is an appropriate and wide spread storage method, even in scientific investigations. This, however, is likely to affect cook loss and possibly shear force. In order to establish a standardized method for the Swiss pig breeding program, the effect of freezing either the fresh or the cooked loin samples was investigated.

II. MATERIALS AND METHODS

Two 3.5 cm thick adjacent slices were taken from the m. long. dorsi (overlaying the 3rd and 4th caudal rib) of a total of 275 pigs. Adhering adipose and connective tissue was removed and the pieces cut to a weight between 80 and 85 g while maintaining the defined thickness of 3.5 cm. The samples were weighed and suspended in plastic bags for 48 h at 2 °C to determine the drip loss. The slices then were further processed according to one of four treatments either without freezing at any point until the shear force measurement was conducted (FF), or being frozen in a raw state before cooking and subjected to the shear force measurement right after cooking and subsequent cooling to ambient temperature (TF), or frozen after cooking (FT), or being frozen twice before and after cooking (TT). The weight of the samples was recorded before and after each treatment (freezing-thawing and cooking. Drip, thaw and cook loss were related to the original weight of the sample e.g. cook loss = (weight before cooking – weight after cooking)/initial weight before measuring drip loss.

The samples were sealed in plastic bags under vacuum and, if so, frozen at -20 °C in a single layer on a shelf. Thawing occurred in a water bath at 20 °C for one hour. The samples were cooked, sealed in plastic bags, in a water bath at 72 °C for 45 min., than cooled down in water of 20 °C for 15 min. and rinsed to remove any coagulated sarcoplasmic protein. For the treatment FT and TT, the cooked samples were again sealed in plastic bags and frozen at -20 °C. After thawing and cooking, the samples were dabbed dry before recording the weight.

For the WB shear force measurement four cores of 13 mm diameter were drilled out of each sample and sheared perpendicular to the direction of the muscle fibres using a TA.HDplus TextureAnalyzer (Stable Micro Systems Ltd, Surrey, UK). The mean of the four replicates was used for further statistical analysis. A pairwise t-test was used to compare the treatments FF vs FT, FF vs. TF, and TF vs. TT.

III. RESULTS AND DISCUSSION

The optimal procedure to measure cook loss and meat texture in pork chops or loin would be to use meat which has not been frozen at any state, as this would be most representative for the commercial practice. Thus, the treatment FF may serve as reference. This method, however, cannot be applied under routine performance test conditions, as the number of samples to be processed is too high to maintain a standardized process with purely fresh samples. The probably most common way to cope with a high number of samples and a restricted analytical capacity is to freeze the meat right after sampling (TF). Compared to FF this led to a slightly lower cook loss of 1.2 % on average, which, however, did not fully compensate the thaw loss of more than 5 % on average (Tab. 1). WB shear force was on average not affected by freezing the raw sample. More important, the correlation between cook loss of the fresh samples and the samples frozen raw is rather poor (R^2=0.29) and the standard error is about twice as high as it was recorded for replicates either fresh (FT:FF) or frozen raw (TF:TT). Thus the prediction of cook loss in a fresh cooked sample from a sample previously frozen raw is not reliable.
Freezing and storing the sample in an already cooked state led to an higher WB shear force, on average by 5 N, regardless of freezing the meat before cooking (TF:TT) or not (FT:FF). This may be explained with the thaw loss of the cooked sample of about 4 % possibly resulting in a slightly more compact texture. The correlation of the shear force in frozen and non-frozen cooked samples is very close (R^2 around 0.8), a prediction therefore well possible.

Table 1 Drip, thaw, and cook loss as well as shear force in differently treated pork loin slices

N=95	TF		FF		p	R^2	SEE
driploss	4.0	±1.7	3.9	±1.6	0.6577	0.87	0.61
thaw loss (fresh)	5.2	±0.8					
cook loss	27.5	±1.9	28.7	±1.6	0.0000	0.29	1.66
WB shear force	34.5	±5.9	34.7	±4.8	0.5145	0.58	3.81
N=86	FT		FF				
drip loss	3.4	±1.2	3.4	±1.4	0.8365	0.85	0.55
cook loss	28.5	±1.9	27.7	±1.6	0.0000	0.81	0.82
thaw loss (cooked)	4.0	±0.6					
WB shear force	39.0	±8.1	35.4	±7.2	0.0000	0.76	3.98
N=94	TF		TT				
driploss	4.2	±1.6	4.2	±1.6	0.9528	0.8	0.71
thaw loss (fresh)	4.7	±0.9	4.8	±0.9	0.5183	0.27	0.62
cook loss	27.1	±1.8	28.0	±1.7	0.0000	0.88	0.86
WB shear force	31.9	±7.3	35.6	±6.9	0.0000	0.82	3.10

TF: frozen before cooking, FT: frozen after cooking; TT: frozen before and after cooking, FF: not frozen

IV. CONCLUSION

The results indicate a significant and rather random effect of freezing raw meat on the cook loss while freezing the already cooked sample significantly affected shear force, but in a fairly predictable way. We therefore conclude that the procedure FT, using non-frozen meat to determine cook loss and freezing the cooked sample to buffer the restricted capacity of the shear force measurement, is the most appropriate way to do the phenotyping for these traits in a pig performance test.

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