MEAT YIELD AND QUALITY: TECHNOLOGICAL QUALITY OF HAMS

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The technological quality of meat reflects its aptitude to be further processed in all sorts of cured, dried, emulsified and/or cooked meat products.

For years and in most pork producing countries, pork technological quality has been mainly assessed through the evaluation of loins colour, texture and water holding capacity. With the exception of a new trend arising from United States where an increasing number of loins are now being injected in order to improve their juiciness, the loin was mainly the sole part of the pig carcass not aimed at further processing. However, because of the inherent biochemical differences of the constituting muscles of the other primal cuts, the technological quality of the loin does not reflect that of these other cuts which in addition contain more than one muscle. This statement is supported by pH, and both objective and subjective colour measurements obtained over recent years in the Longissimus and Semimembranosus muscles of pigs from the market pig evaluation program of the "Centre de développement du porc du Québec inc.". Whenever a difference was reported, Semimembranosus invariably displayed an inferior quality. It was not known however to what extent such observed differences could make in the quality of the final processed product and also if other measurements taken in the Semimembranosus or in some other muscles of the ham could be more reliable predictors of cooking yields and other quality parameters of cooked cured hams.

The literature is scarce on ham technological quality. In addition, processing technologies including new ingredients have been improved or introduced in order to increase cooking yield and reduce the length of the process. However, in spite of these improvements, France has maintained a traditional high quality cooked cured ham product called Paris ham which is produced with a low level of brine addition (< 15%) with no phosphate added or other ingredients in order to improve the water holding capacity of the meat. It is therefore not surprising that France is the only country which has documented the assessment of ham quality for the purpose of genetic evaluation of pigs. The technological yield of Paris ham processing has been the key factor of pork quality in France for more than 20 years but its measurement is expensive ant time consuming. Different equations have therefore been developed since 1969 in order to predict Paris ham technological yield.

In our context, use of adjuncts and improved processing technologies may, to some extent, make up for some technological quality defects of the raw material.

Therefore, a research project was conducted under our processing conditions in order to identify the best predictors of the technological quality of the ham as primal cut. The method had to be precise, non invasive and rapid.

Both hams from carcasses selected on the basis of the ultimate pH value of the Gluteus superficialis (GS) muscle (5.5 ≥pH > 5.86) were used in this study. Some measurements were taken on the left hams at 24 h post mortem on the primal cut as can be obtained from

the cutting room. These measurements were pH of the Semimembranosus (SM) and Gluteus superficialis (GS), L*, a*, b* values of the GS and the Gluteus profundis (GP), and the Japanese colour scale and imbibition time of the GS. After 48 h post mortem, these left hams were injected (40%) with a brine containing phosphates (0.5%), glucose extract (1%), NaCl (2.26%), nitrite (200 ppm) and sodium erythorbate (500 ppm). They were tumbled individually for 18 hours before being cooked in a bag following a commercial schedule. Technological yield (%) was calculated as:

$$\frac{\text{(Cooked weight) X 100}}{\text{Meat weight (before injection)}}$$

The right hams from the same carcasses were used for the estimation of the technological yield in a model system and also for the measurements of pH in the Adductor (AD), Bicep femoris (BF), Vastus intermedius (VI) and Semitendinosus (ST). Glycolytic potential, presence of the halothane gene and proximate analysis were also determined.

In depth statistical analyses were carried out and different predictive models were obtained depending on the time frame available for measurements or access to the carcass or to the cut either as primal joint or boneless ham.

The best possible equation for the prediction of the technological yield obtained from these models is the following:

Technological Yield (%) =
118.5 + 3.26 b* GP + 2.52 jap. colour GS - 0.02 L* GS x a* GP + 0.12 a* GS x a* GP - 0.34 a* GS x b* GP - 0.28 a* GS x jap. Colour GS + 0.28 b* GS x jap. Colour GS

This equation is based solely on objective (L* a* b*) and subjective (japanese colour scale) colour evaluation carried on muscles of the ham face and has a $R^2 = 0.79$ and a RSE = 2.067. Addition of other quality indicators such as pH, soluble proteins or imbibition time did not improve the prediction obtained. The actual equation used in France is: pHμ SM + imbibition time GS - L*GS ($R^2 = 0.55$).

Differences between our equation and the French one can be explained by the respective process employed. In our conditions, curing ingredients and tumbling enhanced protein extraction which can then improve water holding capacity, masking in this way the pH effect retained in the French equation. Interactions among parameters may have also improved our R^2.

This equation makes it a quick, sensitive and non invasive method for the evaluation of ham technological quality. It can be used for the assessment of pigs within breeding program or as a tool for quality control in processing companies. Under industrial conditions, a colorimeter is a much more sturdy piece of equipment in comparison with a pH meter and more particularly its electrode. Measurement of pH, although not mandatory for the evaluation of the technological quality of ham processed under our conditions, could nevertheless remain a valuable measurement to be taken in order to compare with results from other sources.