IMPACT OF MEAT PROCESSINGS ON TECHNOLOGICAL QUALITY OF MEATS FROM TWO DIFFERENT MUSCLE LOCATIONS

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Abstract – The effects of meat processings on technological quality of *longissimus thoracis et lumborum* (LTL) and *M. semimembranosus* (SM) were studied. Meat processing A was carried out to simulate a traditional meat processing in which meats obtained from hot boned carcass, held at 3234 C and subsequently analyzed at 6 h post-mortem (pm). In contrast, meat processing B was carried out to represent cold boned meat from commercial chilling system and analyzed at 24 h pm. The results showed that meat obtained from meat processing A had lower protein oxidation and higher protein solubility (p<0.05) with no effect on lipid oxidation, color and drip loss (p>0.05), as compared to those from meat processing B. However, meat obtained from meat processing B was more tender than those obtained from meat processing A (p<0.05). According to intrinsic variation of muscle location, the LTL exhibited lower pH, protein oxidation and a^* value than SM (p<0.05), but similar proximate composition, lipid oxidation, L^* and b^* values, drip loss and texture (p>0.05). The information gained was clarification of the effect of each meat processing on quality and suitability of raw meat for further processing of specific meat products.

Key Words – Hot boned meat, Meat quality, Pork

- INTRODUCTION

Meat processing encompasses the procedures that start with slaughter and end with post-rigor meat [1]. The early stages in meat processing that follow soon after slaughter have greater implications for the quality attributes of meat, which biochemical and structural changes are associated with the transformation of muscle tissue from the pre-rigor to the post-rigor states [1]. While the end condition of post-rigor meat produces a stable biochemical state, some important changes, particularly the proteolytic events still slowly continue [1]. In Thailand, commercial meat is generally produced by cold boning process in which muscles are excised from carcasses that usually chilled in the chilling room until 1824 h post-mortem (pm) when rigor mortis is completed. Although cold boning process has been widely accepted on the basis of safety and shelf-life, it seems to be restricted by the commercial demands on energy saving, chiller space requirements and increased production efficiency.

Hot boning process could be a potential alternative that allows each muscle to be separated from the carcass in pre-rigor state together with early removal of fat and bone prior to chilling. Therefore, this meat processing would not only enhance the development of "market-ready" products but also increase production efficiency and save energy by reductions of "in-plant" holding time, cooler space and labor requirements. In addition the manipulation of high-temperature conditioning in hot-boning until rigor is also believed to be a means to improve meat quality. To understand the impact of meat processings on meat quality, the

changes in compositions, physico-chemical properties and meat quality was investigated in two major lean meat portions, pork loin, the *M. longissimus thoracis et lumborum* (LTL) and ham, the *M. semimembranosus* (SM) which were different in fiber types composition [2].

- MATERIALS AND METHODS

Pig used in this study, Duroc×(Landrace×Large white), were obtained from Betagro Hybrid International Co., Ltd. (BHI), Thailand. At about 90-120 kg live weight, pigs were transported to a commercial abattoir, Betagro Safety Meat Packing Co., Ltd. (BSM), Lopburi, Thailand. At 30 min pm, four pork carcasses from gilts pigs (female pigs) were randomly selected during the commercial processing plant based on the same hot carcass weight and back fat thickness. Then left sides of hot carcasses (n=2 per treatment) were subjected to 2 different meat processing treatments (A and B) as illustrated in Fig. 1. The LTL between 10^{th} thoracis vertebrae and 4^{th} lumbar vertebrae and the SM were subsequently removed from loin and ham, respectively. Meat pH was measured and proximate composition, thiobarbituric acid reactive substances (TBARS) [3], carbonyl content [4], total sulfhydryl (SH) content [5], disulfide bond content [6], protein solubility [7] TCA-soluble peptide content [7], meat color (L*a*b*), drip loss and Warner-Bratzler shear force (WBSF) were determined**.** Results were subjected to the general linear model (GLM) procedure using the Statistical Package for Social Science (SPSS for windows version 11.5: SPSS Inc.).

- RESULTS AND DISCUSSION

Meat pH, chemical compositions and physico-chemical properties

Meat processing affected changes in pH in which pork from meat processing B showed a slower pH decline than those from meat processing A (data not shown). Due to accelerated anaerobic glycolysis [8], the high temperature applying to meat processing A would contribute a faster muscle pH drop of both LTL and SM as compared to meat processing B. Nevertheless, the effect of muscle location was also observed. The LTL showed a faster pH decline than SM throughout 24 h pm (data not shown). As a consequence, pH of LTL was lower at the end of processing as compared to SM ($p<0.05$) (Table 1).

There was no influence of meat processing and muscle location on proximate composition found ($p>0.05$) (Table 1). It was also indicated that a low variation among animals used to experiment in this research. Both LTL and SM showed a similar value of moisture, protein, fat and ash contents ($p>0.05$).

No differences in TBARS were observed between meats obtained from meat processings A and B ($p>0.05$) (Table 1).

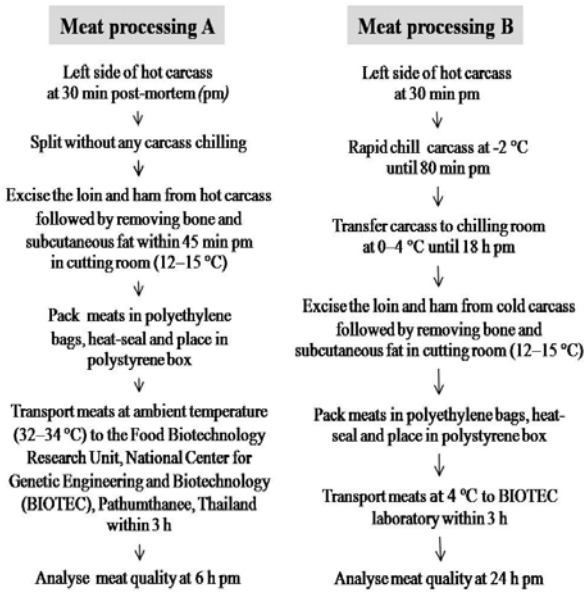

Figure 1. Illustration of treatments for meat processing

Although meats at 6 h pm from meat processing A was held in a higher temperature of 3234 C, muscle tissues have endogenous antioxidant mechanisms to control the oxidative process *in vivo*. Even though there was no significant effect of muscle location on TBARS, the tendency for higher TBARS was found in SM than in LTL. This may be due to a higher percentage of red fibre in SM, which is predominantly oxidative metabolism and more prone to oxidative deterioration [9].

Meat from meat processing A showed a lower protein oxidation as indicated by a lower carbonyl content, higher total SH content and lower disulfide bond content than those from meat processing B ($p<0.05$) (Table 1). Regarding muscle location, the SM exhibited a higher protein oxidation as indicated by a higher contents of carbonyl and disulfide bond with a lower total SH than the LTL ($p<0.05$). In fresh meat, protein oxidation leads to decreased eating quality such as reduced tenderness and juiciness,

flavor deterioration, discoloration and functional changes of proteins, including gel-forming ability, meat-binding ability, emulsification capacity, solubility and water-holding capacity, which can significantly affect the quality of meat products[10].

Meat from meat processing A showed a higher protein solubility than those from processing B ($p<0.05$) (Table 1). A shorter pm time of meat processing A was probably an influential factor for protein solubility. Whereas, the LTL and SM showed a similar protein solubility with no interaction effect ($p>0.05$). The decrease in solubility of protein has been used as a marker of oxidative deterioration of muscle protein [11]. In present study, there was significant correlation between protein solubility and contents of carbonyl ($r = 0.736$, $p<0.05$) or total SH ($r = 0.886$, $p<0.01$) and high correlation between protein solubility and disulfide bond

content (r = 0.680, non significant), while the correlation between protein solubility and pH of meat was not found. Hence, the loss in salt-soluble protein solubility in meats from meat processing B was partly associated with increased protein oxidation.

Different extent of proteolysis in meats from different meat processings was observed as indicated by TCA-soluble peptide. Meat from meat processing A had a lower content than those from meat processing B (p<0.05) (Table 1). It is well established that pm degradation of myofibrillar and associated proteins is responsible for meat tenderness during pm aging caused by the proteinase systems include the calpain system, cathepsins and to a lesser extent, matrix metalloproteinases and caspases [12]. The lower degraded peptides of meat from meat processing A probably due to a shorter period of pm time. For muscle location, the SM exhibited a tendency for a higher content of TCA-soluble peptide than those from the LTL, but both meats were similar response to meat processing (no interaction effect, p>0.05).

Technological meat quality traits

All meat samples in this study were normal and could be defined as reddish-pink, firm, non-exudative (RFN) based on lightness (L^* = 4250), drip loss (< 5%) and ultimate pH (< 6.0) values [13] (Table 1). There was no effect of meat processing on meat color including L^*, a^* *and* b^* values as well as drip loss (p>0.05). With respect to meat texture, meat from meat processing A showed higher WBSF than those from meat processing B (p<0.05). It could be due to a short period of pm time of meat from meat processing A. In contrast, following aging for 24 h pm of meat from meat processing B, meat became more tender as a result of breakdown of muscle structures. Regarding muscle location, the LTL had lower a^* value than SM (p<0.05), while higher L^* and b^* values were similar (p>0.05) (Table 1). The response of these two muscle location to meat processing in terms of meat color, drip loss as well as texture was similar (p>0.05).

- CONCLUSION

Meat quality could be influenced by both meat processing and muscle location. Meat obtained from meat processing A which experienced a high temperature conditioning (~3234 C) and shorter pm time (6 h pm) could bring about lower protein oxidation, proteolysis and more firm texture and protein solubility with no effect on lipid oxidation, color and drip loss. According to intrinsic variation of muscle location, the LTL exhibited lower pH, protein oxidation and a^* value than SM. However, meat processing contributed on a variability of

LTL and SM in the same manner.

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