Genetic lines influence the texture, collagen and intramuscular fat of pork Longissimus and Semimembranosus

Xiying Li [1], Minh Ha [1], Robyn D. Warner [1], Robert J. E. Hewitt [2], Darryl N. DSouza [2], Frank R. Dunshea [1,3]

[1] Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Parkville, VIC 3010, Australia, [2] Sunpork Solutions, Rivett, ACT 2611, Australia., [3] Faculty of Biological Sciences, University of Leeds, Leeds, LS2 9JT, United Kingdom

Objectives: Pork texture is influenced by several factors along the supply chain, including genetic lines and muscles. These factors affect muscle composition, which determines pork texture. This study aimed to 1) determine the effects of different genetic lines and muscles on the texture, collagen and intramuscular fat of pork; and 2) investigate the contributions of collagen and intramuscu- lar fat to pork texture.

Materials and Methods: *Longissimus thoracis et lumborum* (LTL) and *Semimembranosus* (SM) were excised from pigs from 6 ge- netic lines (A - Pure maternal, Landrace-type; B - Pure maternal, Large White-type; C - Pure maternal, Duroc-type; D - Synthetic terminal, Large White and Landrace-type; E - Pure terminal, Duroc-type; F - Pure terminal, Large White-type; n = 12 for each line) at 24h post-mortem, vacuum packed and frozen before shipping to the University of Melbourne. A cube of 110 ± 10g was cut from each frozen sample and was vacuum packed. The vacuum packed cube was cooked in a water bath at 75°C until the internal tem- perature reached 70°C. Cooking loss, Warner-Bratzler shear force (WBSF) and texture profile analysis (hardness, cohesiveness, ad- hesiveness, chewiness, resilience and springiness) were measured (Abhijith et al., 2021). Collagen content and solubility were de- termined using a colourimetric method (Starkey et al., 2015). Intramuscular fat (IMF) content was measured using AOAC method 991.36 with a Soxhlet extraction apparatus (AOAC, 1995). Data were analyzed by analysis of variance (ANOVA) with genetic line and muscle as factors in GenStat (16th Edition, VSN International). Correlation matrices were obtained in RStudio (RStudio, PBC). **Results and Discussion:** When comparing between muscles, the LTL showed higher cooking loss (17.5 vs 16.1%, p=0.001) and WBSF than SM (35.0 vs 31.0N, p=0.003). However, SM had higher hardness (35.7 vs 34.1N, p=0.036), adhesiveness (11.7 vs 9.53 Nmm, p<0.001), chewiness (12.7 vs 11.5N, p<0.001) and springiness (0.799 vs 0.760, p<0.001). In addition, SM exhibited higher IMF content (2.10 vs 1.19%, p<0.001) and collagen content (6.47 vs 5.23 mg/g fresh meat, p<0.001) and lower collagen solubility (7.64 vs 10.4%, p<0.001). The LTL and SM differed in their texture and chemical composition. Genetic lines affected pork hard- ness (p=0.039), cohesiveness (p=0.023), collagen content (p=0.043) and IMF (p=0.003). Line D had the highest hardness (37.1 N) and cohesiveness (0.453), while line B showed the lowest hardness (33.3 N) and cohesiveness (0.425). Collagen content ranged from 5.47mg/g of fresh meat in line D to 6.28mg/g of fresh meat in line F. However, line D had lower IMF content (1.08%) than all other lines (1.69 - 1.82%). Collagen content was positively correlated (p<0.05) with hardness (r=0.20), adhesiveness (r=0.29), chewiness (r=0.27) and springiness (r=0.30), while collagen solubility was negatively correlated (p<0.05) with chewiness (r=-0.18) and springiness (r=-0.22). IMF was negatively correlated (p<0.05) with cooking loss (r=-0.18) and WBSF (r=-0.29) and positively with adhesiveness (r=0.25) and springiness (r=0.34). In the LTL, collagen content was correlated with WBSF (r=0.26), hardness (r=0.24), adhesiveness (r=0.24) and chewiness (r=0.26), while IMF was correlated with WBSF (r=-0.24). No significant correla- tions were found in the SM (P>0.05 for all). In regard to the effects of genetic lines, collagen content was correlated (p<0.05 for all) with hardness in line E (r=0.55), with adhesiveness in lines B, D and E (r=0.49, 0.41 and 0.47, respectively), with chewiness in line B, D and E (r=0.44, 0.42 and 0.72, respectively), and with springiness in line B and E (r=0.57 and 0.53). IMF content was cor- related (p<0.05 for all) with WBSF in line E (r=-0.41), cohesiveness in line D (r=0.46) and with springiness in line A (r=0.53). No significant correlation was found in lines C or F (p>0.05).

Conclusions: : The SM was tougher and showed a stronger structure than LTL, with higher collagen and IMF content and lower col- lagen solubility. Genetic lines influenced pork texture and chemical composition and the muscles in line D were the hardest and leanest. Collagen characteristics and IMF weakly contributed to pork texture, but only in the LTL. The genetic line affected the contribution of collagen and IMF to pork texture, and collagen significantly affected pork texture in lines B and E. 5.

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