THE EFFECT OF FREEZING TIME ON THE SHEAR FORCE AND TVB-N VALUE OF NORMAL AND PSE PORK

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I. INTRODUCTION

Pork quality defects such as dark firm and firm (DFD) and pale, soft and exudation (PSE) affects the manufacturability, eating quality and can have dramatic effect on the pork industry due to low yield and poor sensory attributes. Total volatile basic-nitrogen (TVB-N) has been used as a freshness indicator in fish [1] and pork [2]. The TVB-N contains low molecular weight metabolites (e.g. trimethylamine and dimethylamine) and protein degradation products such as ammonia and other nitrogenous compounds, which are normally generated during post-mortem storage. These compounds can exert dramatic effects on the sensory and acceptability of muscle food products. The accumulation of these compounds over storage time makes them useful indicators of freshness and quality. However, the general understanding of the relationship between TVB-N, meat quality and short to medium term storage time of frozen pork is poor, especially in pork of different quality categories, i.e. PSE, DFD and normal. Therefore, the present study aimed to investigate the changes in thawing loss, pH, TVB-N, protein content, shear force and muscle structure of LTL and BF muscles of PSE and normal pork over 18 weeks of frozen storage. Only shear force and TVB-N are reported here.

II. MATERIALS AND METHODS

Pigs (Duroc × Landrace ×large white) from the same farm were slaughtered by TECON Group (Urumqi, Xinjiang, China). Twelve carcasses were selected based on the muscle pH at 45 minutes post-mortem with six carcasses had pH <6.0 (PSE meat) and six carcasses had pH > 6.0 (normal meat). The hot carcass weights were 76.98 ± 3.00 kg (PSE meat) and 78.42 ± 1.62 kg (normal meat). Each LTL muscle was processed into seven blocks of 4 cm thickness that was assigned to 0, 3, 6, 9, 12, 15 and 18 weeks of storage at -18°C. Each BF muscle was processed into three blocks that randomly allocated into 0, 3 or 18 weeks of storage at -18°C. The samples were weighed, individually vacuum-packed and frozen at -18°C until the designated sampling time. TVB-N contents of the pork samples were measured by the steam distillation method as described by Huang et al [3]. The shear force was determined using a TA.XT.Plus texture analyzer with a Warner-Bratzler shear device attachment. The data were analysed using MINITAB (version 16.2.4). The effects of the storage time and meat type (normal and PSE) on the measured parameters (TVB-N and shear force) were determined using analysis of variance (ANOVA). The significance of the difference between the means was determined by Tukey`s test ($P < 0.05$).

III. RESULTS AND DISCUSSION

A significant increase in the TVB-N content of the LTL muscle samples was observed at weeks 12 and above storage times in normal samples compared to 0 and 3 weeks of time samples (Figure 1A). There were no differences found among normal samples stored at 9, 12, 15 and 18 weeks. PSE meat samples at 12, 15 and 18 weeks of storage at -18°C had significantly higher TVB-N values compared to 0, 3 and 6 weeks of storage. No significant differences were found in normal and PSE samples at all storage time points. The BF samples had similar

trends to those found in LTL samples with no differences between normal and PSE samples and significantly higher TVB-N contents in samples stored for 18 weeks compared to 0 and 3 weeks samples (Figure 1B). The shear force of LTL was affected by treatment, frozen storage time and their interaction ($P < 0.05$) (Figure 2A). The shear force at weeks 3 and 6 was decreased in both PSE and normal pork LTL muscles by about 25%, but the reduction was only significant ($P < 0.05$) in PSE samples. An increasing trend was observed from week 3 onward with pork samples at week 3 and 6 had lower shear force than samples stored for longer times. There were no significant differences between LTL PSE and normal meat samples, except for the 0-time point where the normal pork had significantly ($P < 0.05$) lower shear force (Figure 2 A). The shear force of the BF muscles was affected by treatment, frozen storage time and their interaction ($P < 0.05$, Figure 2B). The shear force of BF 0 and 3 weeks of storage time was significantly higher in PSE samples than normal samples, but no difference was found after 18 weeks of frozen storage.

IV. CONCLUSION

Freezing for 3 or 6 weeks at -18°C improved the tenderness of LTL muscle but not BF muscle. No significant difference in TVB-N content was found in PSE and normal pork during 18 weeks of frozen storage.

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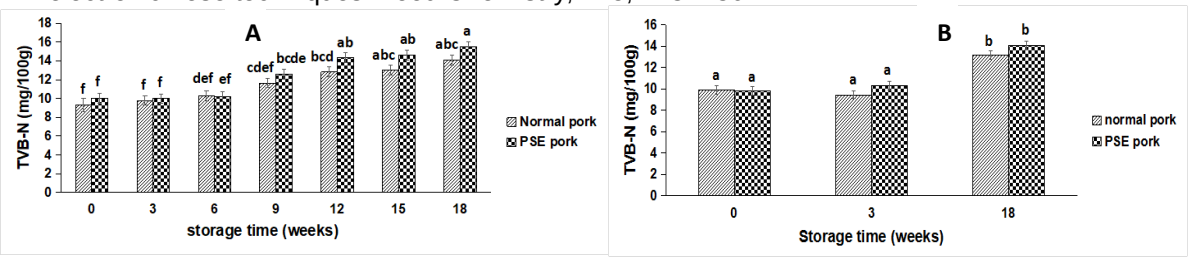

Figure 1. Effect of storage time on the TVB-N content of PSE and normal pork *Longissimus et lumborum* (A) and *Biceps femoris* (B) muscles stored at -18°C.

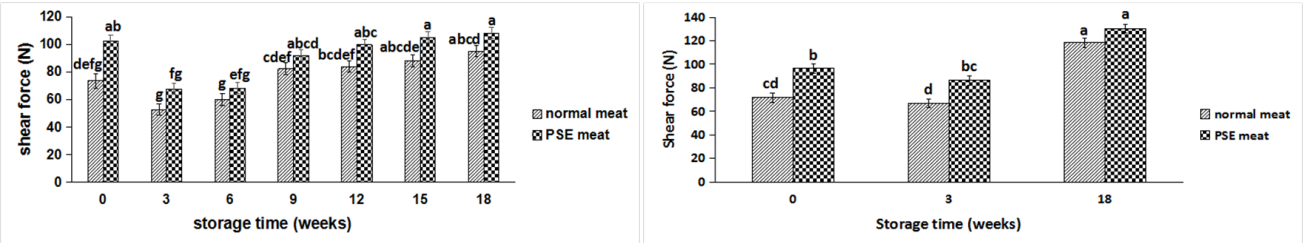

Figure 2. Effect of storage time on shear force (N) of PSE and normal pork *Longissimus et lumborum* (A) and *Biceps femoris* (B) muscles stored at -18°C.