THE EFFECT OF SEASON AND POST-TRANSPORT REST ON ALPACA (Vicunga pacos) MEAT GLYCOGEN CONTENT AND ULTIMATE pH VALUES

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I. INTRODUCTION

Increasing interest in the Australian alpaca meat industry is driving research into alpaca muscle biochemistry and product quality. Recent research has focused on determining lean meat yield and improving product consistency through post-slaughter methods. Little consideration has been given to product variability across season and the effects of pre-slaughter stressors such as transportation and lairage on alpaca meat quality. This is primarily due to a limited industry size and minimal commercial transportation to date, a variable that is rapidly changing within industry. Season has been shown to have significant impacts on both beef and lamb quality due to exposure to heat and cold stress, and nutritional variability [1, 2]. In addition, pre-slaughter stressors have been proven to result in glycogen breakdown and increased ultimate muscle pH (pHu) [3]. Resting livestock with access to feed post-transport can allow physiological recovery and improve meat quality traits in multiple species [4]. Given that literature for alpaca in relation to pre-slaughter factors impacting meat quality is limited, the current study aimed to report variation in alpaca muscle glycogen and pHu values across seasons and to determine if a 7-day rest period post transport would alter glycogen concentration and or pHu in alpaca.

II. MATERIALS AND METHODS

A total of 160 animals were transported 4 hours to slaughter over a 12 month period. Animals were moved in two groups of 20 per season (n = 8 transport groups). Immediately following transport, animals were allocated to one of the following treatment groups; (1) Overnight lairage pre slaughter and (2) 7-day rest period with access to feed pre-slaughter, resulting in four kill groups per season (n = 10 animals per processing). Animals were processed as whole carcases through a commercial camelid certified abattoir on the south coast of NSW, Australia. Prior to entering chillers, a glycogen core sample was collected from the *longissimus lumborum* (LL) between the 12th/13th ribs, on the right hand side of each carcase and snap frozen in liquid nitrogen. Samples were stored at – 80 ºC prior to analysis. At 24 h post slaughter, an additional 5 g sample was collected from the LL and aged for 10 days prior to the determination of pHu. Samples were stored at – 20 ºC until subsequent analysis.

Glycogen content was determined using a commercial glycogen assay kit (Sigma-Aldrich, MO, USA) with the method outlined previously [5]. Absorbance was measured at 570 nm. Ultimate pH samples were homogenised in an iodoacetate buffer and measured at 22 ºC [5].

Glycogen and pHu data were analysed separately using Linear Mixed Models (LLMs) in Genstat (18th edn.). Fixed effects included Season, Lairage Treatment (direct vs rested) and a Season × Lairage Treatment interaction term (which was later dropped from the models on the basis of non-significance at the $P < 0.05$ level). Carcase and kill date were included as random terms, along with pH test date for the pHu model and plate number for the glycogen model.

III. RESULTS AND DISCUSSION

Glycogen concentration varied significantly (P = 0.008) across seasons (Table 1). While there were no significant differences (P = 0.107) between pHu values across seasons, there was a trend toward lower pHu at greater glycogen concentrations, such that a glycogen concentration of ~ 40 mmol/kg resulted in a pH of 5.6 and 50 mmol/kg resulted in pH 5.5. This is similar to glycogen thresholds reported for beef, where 57

mmol/kg was required to reach a pH of 5.5 [6]. However, previous literature has also indicated that pH fall will be limited below glycogen concentrations of 40 – 45 mmol/kg in beef and lamb [3, 7]. Results from this study indicate that a glycogen concentration beyond this lower threshold will still result in desirable pHu within alpaca, which could be attributed to the comparative glycolytic nature of alpaca muscles [8]. Glycogen concentration in the current study is lower than previously reported for alpaca (74 mmol/kg), where pHu also dropped to 5.5. This variation may be a result of differing protocols utilised for glycogen determination or simply due to greater feed availability in the past study. Further research is required before estimated standard glycogen content within the alpaca muscle can be proposed, and consideration should be given to seasonal variation as is evidenced by this study.

Table 1 The effect of season on glycogen content and ultimate pH (pHu) in the alpaca *longissimus lumborum* (LL)

Season	Glycogen (mmol/kg)	Ultimate pH
Winter	42.8 ± 2.77^{bc}	5.56 ± 0.04^{a}
Spring	52.9 ± 2.77^{a}	5.47 ± 0.05^{a}
Summer	49.9 ± 2.77^{ab}	5.53 ± 0.05^{a}
Autumn	37.1 ± 2.77^{c}	5.56 ± 0.05^{a}

Resting had no effect ($P = 0.132$) on muscle pHu, despite glycogen concentration being slightly higher ($P = 0.037$) for animals sent direct to slaughter (49.0 ± 1.96 vs 42.4 ± 1.96 for rested group). Stressors related to interspecies contact, noise and unfamiliar surroundings at the abattoir during the rest period may have contributed to lower muscle glycogen concentration comparative to the direct to slaughter group. Regardless, muscle pHu remained unaffected by lairage treatment. Results indicate that a 7-day rest period is not beneficial to re-establishing glycogen reserves in the alpaca muscle post-transport.

IV. CONCLUSION

Glycogen concentration varied significantly across seasons. However, pHu did not change suggesting seasonal variation in glycogen concentration will not impact on overall product pH. Resting animals for 7-days post-transport does not increase muscle glycogen reserves or change pHu.

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