VITAMIN E CONCENTRATION IN ALPACA MEAT AND ITS IMPACT ON OXIDATIVE TRAITS DURING RETAIL DISPLAY

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I. INTRODUCTION

Meat exposed to oxygen during retail display undergoes lipid oxidation and changes in surface metmyoglobin levels, which result in unfavorable odours, aromas and increased meat surface browning [1]. The rate and extent of oxidation is dependent upon the amount of intramuscular fat (IMF), proportion of fatty acids within the fat and the presence of antioxidants [2]. Previous literature on alpaca meat has reported low levels of IMF (< 1 %) with correspondingly low levels of lipid oxidation (< 2.44 MDA/ kg meat) and minimal surface browning across 72 hrs of simulated retail display [3]. These low levels of oxidation are favorable, when compared to other species, as the product appears to remain in a saleable state without having to be discounted due to lipid oxidation and/or unacceptable levels of product brownness [4]. Currently it is not known if naturally occurring antioxidants in meat, such as vitamin E, are contributing to the low levels of oxidation in alpaca meat. Vitamin E content of meat has been shown to help reduce oxidation in beef and lamb [5] and it is naturally obtained through the consumption of green pasture. As alpacas are managed under pasture based systems, research into the effects of vitamin E on alpaca meat oxidative traits may be beneficial to explaining the low oxidation levels previously observed for alpaca and may also provide some insights beneficial to other red meat species. As such the aims of this study were to; (1) investigate the levels of vitamin E in two alpaca muscles; and (2) determine if the levels of vitamin E impacted on lipid oxidation and meat colour stability traits across a 72 hr retail display period.

II. MATERIALS AND METHODS

The *longissimus thoracis et lumborum* (LL), and *adductor femoris* (AF) muscle samples were boned out from one side of 39 castrated huacaya alpaca carcasses, 24 hrs after processing. The carcasses were processed on two separate days a fortnight apart with animals being randomly sourced from the same producer to reduce nutritional variation given the small sample size. A 20 g sample of LL and AF was taken for vitamin E determination and a 40 g sample of LL for IMF determination. The remaining sections of the LL and AF muscles were vacuum packed and aged for 5 days. After aging the samples were divided into an ultimate pH, a pre thiobarbituric acid reactive substances (TBARS) sample and a 3 cm thick steak, which was prepared for 72 hr simulated retail display using methods previously described [3]. A Hunter Lab Mini ScanTM XE Plus was used to record colour traits (L* (lightness), a* (redness), b* (yellowness) and 630 nm / 580 nm wavelength ratio (from here on referred to as oxy/met ratio)) at 4 time periods (0, 24, 48 and 72 hrs) throughout the simulated retail display. After display a post display a TBARS sample was taken. The statistical analysis was conducted using the software package *GenStat* (*17th edition*). Linear mixed models (LMM) were generated for each trait to determine interactions, the effects of co-variates and to account for relevant random terms. Significance was determined at the $P < 0.05$ level and a stepwise backward elimination approach was applied to each model. Significance between predicted means was determined using LSD's.

III. RESULTS AND DISCUSSION

The alpaca meat contained high concentrations of vitamin E, with the AF having a significantly higher concentration (6.13 ± 0.62 mg/kg) than the LL (5.40 ± 0.62 mg/kg). These vitamin E concentrations are higher than previously reported for LL of pasture fed lamb (2 mg/kg; [5] - 3.7 mg/kg [6]) and vitamin E supplemented grain finishing rations (2.1 – 5.1 mg/kg [6]). The intermuscular variation observed in this study has been

previously reported in lamb and can be attributed to biochemical variation between muscles [6]. Irrespective of the high concentration of vitamin E there was no significant impact of vitamin E on colour stability or oxidation traits before, and/or after retail display ($P > 0.05$). While this finding is unexpected, it could be explained by the high levels of vitamin E occurring in both muscles, as research in lamb has shown that retail colour stability is improved when vitamin E values are in excess of threshold values 3.5 - 4 mg/kg [6]. Further research would need to be conducted to validate this suggestion and to determine threshold values for alpaca meat.

Retail colour stability traits remained favorable, with small declines in oxy/met levels observed in both muscles.A decline of 1.1 was observed in the AF and a decline of 0.35 in the LL throughout retail display. Initial oxy/met ratio values were higher in the AF than the LL, but at 24h and thereafter the difference between muscles was minimal ($P > 0.05$), resulting in a peak at 24h followed by a steady increase in brownness (decrease in oxy/met ratio). Retail colour L*, a*, and b*, followed similar trends to previously reported alpaca colour traits [3]. Length of retail display impacted on all three traits in both muscles, such that peak values were observed at 24 h followed by steady declines in values as retail display continued ($P < 0.001$). Alpaca muscle oxidation levels were below 1.2 MDA/kg at both pre and post display periods, irrespective of muscle and well below suggested sheep oxidative threshold values of 3-4 mg MDA/kg. Both muscles followed the same trend with TBARS values increasing by 0.2 MDA/kg post retail display ($P < 0.05$). There was a significant *retail display x muscle* interaction such that the LL had lower oxidation levels than the AF, and pre display AF TBARS (1.01 ± 0.08 MDA/kg) were similar to the LL TBARS post display values (1.01 ± 0.08 MDA/kg). These low levels of lipid oxidation are in line with previous literature on alpaca meat oxidation [3] and the high levels of vitamin E observed in this study.

IV. CONCLUSION

Alpaca meat contains high levels of vitamin E in both the LL and AF muscle compared to other red meat species. Vitamin E content had no significant impact on colour stability or oxidation traits during retail display. This is thought to be due to the levels of vitamin E being above threshold values resulting in low levels of increased surface browning and lipid oxidation during retail display. Further research is warranted on a large sample sizes to further explore these favorable relationships between antioxidant concentrations and meat quality traits in alpaca with a view to understanding changes in other red meat species.

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