THE QUALITY OF LAMB MEAT THAT IS AGED FOR UP TO 20 WEEKS

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I. INTRODUCTION

Long-term chilled storage is being considered as an alternative to the current practices used for the export of Australian lamb meat. This decision is based on shorter term studies (< 20 weeks) and investigations of chilled beef products [1]. To provide confidence, specific to lamb processors, the microbial load of lamb meat that is held under long-term chilled storage must be quantified. In addition, the preservation of lamb meat quality and sensory attributes throughout a long-term chilled storage period must be confirmed. This information will ensure the marketability and safety of long-term chilled lamb meat to its end consumer. This study aimed, therefore, to examine the microbial load and quality of vacuum packaged lamb meat that was stored chilled (aged) for periods of up to 20 weeks.

II. MATERIALS AND METHODS

From the boning room of an Australian abattoir, 48 denuded m. *longissimus lumborum* (LL) were selected at random. These were vacuum packaged and allocated, at random, to each of 8 chilled storage periods (0, 1, 2, 6, 10, 14, 18, or 20 weeks; n = 6 per storage period). Samples were held at -1.2 ± 0.9 °C (mean ± SD) for the duration of their storage period and then analysed for purge loss, drip loss, cooking loss, shear force, and total viable microbial count (TVC). Data were analysed in Genstat (22nd Ed.) using linear mixed models (REML) fitted with the fixed effect of storage period and the random effect of LL within storage period. Least significant means were different when $P \leq 0.05$.

III. RESULTS AND DISCUSSION

The cooking loss of samples was higher at Weeks 0-2 than was found when storage periods were ≥ 18 weeks ($P < 0.05$). Drip loss was lower at Weeks 6-18 than was found for Weeks 1-2 ($P < 0.05$). Furthermore, purge loss was found to increase as storage period increased, being lower at Week 0 than at Week 20 ($P < 0.05$). These variations may be indicative of proteolysis and the associated degradation of cytoskeletal linkages, within the meat matrix, that can contribute to the expulsion of water [2]. The increase and subsequent decline in these water-holding capacity measures, as storage period continued, could be the result of vacuum packaging – i.e., the in-pack pressure could shift the water distribution within the LL, causing cells to 'swell' rather than contribute to water loss [3].

Table 1 The quality of lamb m. *longissimus lumborum* stored chilled for periods of up to 20 weeks.

Quality variable	Chilled storage period, weeks								SEM	P-value
	0	1	2	6	10	14	18	20		
Cooking loss, %	24.5^{c}	24.0^{c}	23.9^{c}	22.1^{bc}	20.2^{ab}	23.1^{bc}	18.7^{a}	17.0^{a}	1.7	< 0.001
Drip loss, %	0.78^{ab}	1.20^{bc}	1.48^{c}	0.50^{ab}	0.45^{a}	0.44^{a}	0.41^{a}	1.57^{c}	0.36	0.003
Purge loss, %	3.58^{a}	2.79^{a}	4.17^{a}	3.13^{ab}	5.29^{ab}	6.15^{ab}	8.57^{bc}	9.84^{c}	1.69	0.002
Shear force, N	48.5	40.0	36.9	47.0	40.6	44.3	40.5	40.3	6.8	0.665
Total viable count, log CFU/g	3.55^{a}	3.56^{a}	3.40^{a}	4.79^{b}	6.90^{d}	6.82^{d}	5.74^{c}	6.12^{c}	0.32	< 0.001

Storage period did not impact on sample shear force values ($P > 0.05$). There was, however, substantial variance (SEM) observed in the shear force data which may have obfuscated the fixed effects. Alternatively, the contributions of connective tissue to the shear force of samples, noting their relative stability across chilled storage durations [4], may have resulted in their being no significant change to shear force. These factors require investigation.

TVC increased between Week 0 and Week 14, whereafter values declined ($P < 0.05$). Based on the mean TVC, being < log 7 CFU/g, it was reasonable to conclude that all the lamb meat samples were unspoilt, irrespective of storage period. The initial microbial load of lamb meat that is stored for long-term periods could affect the transference of this finding. Nonetheless, this result could be from the inhibitory actions of vacuum packaging (anaerobic conditions) on the in-pack proliferation of aerobic microbiota as well as from the relatively cold chilled storage temperatures used in the study [5]. TVC does not, however, predict the presence of all the microbes that are associated with meat spoilage and safety. Sensory parameters, such as colour and flavour, would also contribute to the perception of spoilage. Sensory evaluation and molecular methods for the quantification of specific microbial populations is necessary to confirm these findings.

IV. CONCLUSION

The water-holding capacity of lamb meat changed with long-term chilled storage, whereas tenderness (shear force) was consistent across the 20-week period. Microbial load was highest at Weeks 10-14 but remained at levels below current spoilage guidelines for red meat (≥ log 7 CFU/g). Long-term chilled storage could, therefore, have practical value towards the preservation of Australian lamb meat quality and safety parameters. Further investigation is necessary to confirm these findings.

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