Fatty acid composition of retail cuts from carcases from grass fed lambs

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I. INTRODUCTION

Over the last 3 decades, the consumer preferences for meat products have been changing as time poor consumers have been seeking healthier, more convenient meat products. This is particularly challenging for lamb meat cuts as they are traditionally perceived as large whole leg or shoulder roasts which are high in fat while heath guidelines have advocated low fat diets. Yet lamb like other red meats, is an important source of protein, vitamins and minerals in the diet, however a large scale literature review recently revealed that there is very little nutritive information available for lamb cuts, particularly value added cuts which suit the modern consumer [1].
Therefore, the aim of this research was to determine the fatty acid composition of retail cuts derived from carcases of grass fed lambs, with a particular focus on value added cuts which were identified as having no nutrition data available from the hindleg and forequarter.

II. MATERIALS AND METHODS

Samples from grass-fed lambs were collected from 4 lots of animals over 4 consecutive months (August, September, October, November) which were verified as consuming only pasture including mixed pastures of ryegrass, clover and phalaris from weaning until slaughter when lambs were processed using standard commercial procedures. At 24 h post mortem, the knuckle (HAM 5072), silverside (HAM 5071), outside (HAM 5075), topside (HAM 5073), eye of shoulder (HAM 5151) and eye of short loin (HAM 5150) [2] were removed from 20 carcases representing a range in fat depth and carcase weights. Fatty acid concentrations were determined using a one-step extraction based on the method of Lepage and Roy [3]. Once extracted, fatty acids were identified from FAME using an Agilent 6890N gas chromatograph (GC) equipped with a SGE BPX70 analytical column. Variation in fatty acids associated with cut was estimated using linear models and least squares means and standard errors for the trait under each level of the design factors were calculated. The analysis was constructed in the R environment [4] with the ‘emmeans’ package [5].

III. RESULTS AND DISCUSSION

As shown by Table 1, the loin had the lowest concentrations of saturated fatty acids (SFA) and monounsaturated fatty acids (MUFA), yet it also had the lowest concentrations of polyunsaturated fatty acids (PUFA), which are similar to previous studies on the loin of extensively finished lambs in Australia [6]. However, despite being statistically different, this variation in PUFA concentrations does not correlate with a significant change in terms of human health as the change is relatively low. This highlights the impact of total fat content on the concentration of major fatty acids as cuts which contain higher fat content contain higher concentrations of SFA and MUFA. As fat deposition continues within the carcase, the proportions of neutral lipids and phospholipids also change. While MUFA and SFA are present in muscles as part of the triglyceride fraction, PUFA are present in the phospholipid fraction which is held bound in the cellular membrane of the myofibril [7]. Subsequently, increases in fat content of muscle results in increasing triglycerides, which results in increasing SFA and MUFA while the PUFA content remains constant [8].

Table 1. Least square means and standard errors of major fatty acid composition measured for the compact shoulder roast, eye of shoulder, knuckle, loin and topside sampled from carcases of lambs produced in grass fed systems.

Trait	Compact Shoulder Roast	Eye of Shoulder	Knuckle	Loin	Topside	S.E.M.
SFA (g/100g)	6.2c	7.3d	2.9b	1.9a	2.9b	0.2
PUFA (g/100g)	0.5b	0.6b	0.4a	0.3a	0.4a	0.02
MUFA (g/100g)	4.0c	4.6d	2.3b	1.5a	2.2b	0.1
DHA + EPA (mg/ 100g)	36.9ab	32.0a	37.4ab	37.9ab	43.3	2.4
n-6 : n-3	1.2	1.2	1.4	1.4	1.3	0.1

Although there was no significant variation in the n-6:n-3 ratios between cuts (Table 1), these ratios are similar to the ratio of 1.3 which has been previously reported [9], which is unsurprising given that lambs in both of these studies were extensively finished. However, the concentration of the health beneficial fatty acids EPA and DHA found in this study are higher than those previously reported for Australian lamb [10] indicating that knuckle, topside and loin all meet the nutritional requirements to be called a source of Omega-3 FA as they contain under 5g/ 100g of SFA and over 30mg/100g of EPA and DHA [11]. Although the SFA content of the eye of shoulder and compact shoulder roast prohibits the claim being made about the shoulder cuts.

IV. CONCLUSION

Overall, this study indicated that there is variation in the fatty acid composition of leg and forequarter retail cuts from lambs which have been extensively finished. Given the paucity of research which has been conducted on such retail cuts it is difficult to determine the reasons behind some of these differences. As the Australian lamb industry is diverse with carcases exhibiting a range in weight and fat depth produced in different production systems and environments, further research is needed to determine the extent of the variability in nutritional composition, particularly health beneficial fatty acids, to ensure that nutritional claims made at point of sale are accurate over time.

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