Nutritional composition of leg cuts from carcasses of grain fed lambs

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I. INTRODUCTION

Aligning meat products with consumer preferences is an ongoing challenge for lamb producers and processors as consumers are becoming increasingly health conscious. Particularly as heath guidelines over the last 3 decades have advocated low fat diets. However, red meat is also an important source of protein, vitamins and minerals essential for human health. Despite the crucial role of key nutritional components found in meat, a recent large scale literature review conducted on lamb highlighted that there is a paucity of nutritional data currently available for retail cuts [1]. Therefore, the aim of this research was to determine the nutritional composition of key components of lamb, including protein, fat, energy, vitamins and minerals with a particular focus on value added cuts identified as having no available nutrition data, such as leg and forequarter cuts.

II. MATERIALS AND METHODS

Samples from 30 grain-fed lambs representing a range in fat depth and carcass weights were collected from a population of 200 mixed sex lambs which were fed a diet which consisted of mainly barley, triticale, oats and lucerne hay. Groups of lambs were fed for 70 and 160 days before being processed using standard commercial procedures. At 5 d post mortem, the knuckle (HAM 5072), silverside (HAM 5071), outside (HAM 5075), topside (HAM 5073) and eye of shoulder (HAM 5151) [2] were removed from a total of 30 carcases (15 each group). Energy was analysed using a bomb calorimeter method [3]. Total protein content was determined using a LECO analysis method (Leco FP628 Nitrogen analyser, Leco Corp., UK). Fat content was determined using a soxhlet method [4]. Selected mineral contents (Zn, Fe and K) were determined using a microwave digestion [5].Variation in each nutritional trait associated with cut class was estimated by a linear model 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 [6] with the 'emmeans' package [7].

III. RESULTS AND DISCUSSION

As highlighted by Table 1, the eye of shoulder had significantly more protein, fat and energy compared to the other cuts. These observed differences between fat content of the retail cuts may result from differences in proportions of lean and fat between the cuts measured as some cuts do not contain the intermuscular fat compared to cuts which contain multiple muscles.

Table 1. Least square means and standard errors of protein, fat and energy measured for the knuckle, outside, silverside (cap on and cap off), topside (cap on and cap off) and eye of shoulder sampled from carcases of lambs fed a grain ration.

Trait	Knuckle	Outside	Silverside Cap On	Silverside Cap Off	Topside Cap On	Topside Cap Off	Eye of Shoulder	S. E. M.
Protein (g/100g)	19.8a	21.0a	21.3a	24.6b	24.9b	21.3a	34.1c	0.6
Fat (g/100g)	6.8a	7.2a	11.3b	10.6b	10.6b	6.0a	22.0e	0.4
Energy (kJ/ 100g)	714a	763abc	925d	801c	785bc	729ab	1057e	15.2

The higher fat levels in these cuts may also explain the higher energy content found for leg and forequarter muscles in comparison to figures previously reported [8, 9] as fat is more energy dense and therefore muscles with a higher amount of fat will also contain higher energy. Yet it must be noted that the data obtained from these animals is likely to be atypical for commercially supplemented lambs in Australia due to the extended period that these lambs were fed a concentrate diet.

As shown in Table 2, there was little difference between iron levels in leg cuts, however eye of shoulder had a significantly lower iron content. Similarly, there was little difference in zinc contents of most leg cuts, although the knuckle and eye of shoulder had significantly higher concentrations. It is hypothesised that differences in zinc and iron content is likely to be due to muscle fibre type as there is a difference between the mineral levels of red and white muscle fibres as a result of vascularity, function and anatomical location with more red muscle fibre types containing more zinc [10-12].

Table 2. Least square means and standard errors of mineral composition measured for the knuckle, outside, silverside (cap on and cap off), topside (cap on and cap off) and eye of shoulder sampled from carcases of lambs fed a grain ration.

Mineral (mg/100g)	Knuckle	Outside	Silverside Cap On	Silverside Cap Off	Topside Cap On	Topside Cap Off	Eye of Shoulder	S.E.M.
Iron	1.9bc	2.0cd	1.9bc	1.8b	2.1d	2.2d	1.4a	0.05
Potassium	338.9bc	352.1bc	358.8c	358.9c	331.1b	360.5c	248.9a	5.8
Zinc	4.5c	3.1a	3.1a	3.2ab	3.3ab	3.5b	4.2c	0.1

IV. CONCLUSION

Overall, this study indicated that there is variation between retail cuts for the nutritional composition between retail cuts from the leg and forequarter from lamb carcases which have been fed grain. However, given the paucity of research which has been conducted on retail cuts from the forequarter and leg, it is difficult to determine the reasons behind some of these differences as many studies have focused on the difference in nutritional traits of the loin. Thus, there is still a need for further research to determine the impact of factors including season, time on feed, breed, genetics, muscle fibre type, age and gender on the nutritional composition of these cuts to ensure that nutritional claims are representative of the products.

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