IMPACT OF DIET ON LAMB MEAT QUALITY

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I. INTRODUCTION

Meat is a good source of protein and minerals, particularly iron. However, health concerns about saturated fatty acids have led to efforts to change the fatty acid profile and increase the proportion of omega 3 fatty acids[1]. The diet of sheep can affect the fatty acid profile of their meat[2]. The aim of this study was to confirm earlier research of the beneficial effects of legumes on fatty acid composition of lamb and to determine whether a relatively short-term change of diet to cereal-based concentrate would alter the fatty acid profile.

II. MATERIALS AND METHODS

Two groups of 8 lambs were randomly selected from the Lincoln University Coopworth flock in 2010. The pasture group continued to graze on rye grass-clover (organic content 93%, fat 2.9%, protein 11%) at a stocking rate of 4 lambs per hectare. The concentrate group were housed indoors from 12 weeks and fed cereal-based pellets (dry matter 87%, fat 2.1%, protein 14.1%). A separate group of 8 Coopworth lambs was grazed on lucerne pasture from weaning. All lambs were slaughtered at 18 weeks. Samples (10cm) of the longissimus were removed from the lumbar region after 48 hours, vacuum packed and stored at -20°C. All samples were analysed for pH at 24 hours, shear force at 48 hours and mineral content by ICP. Fatty acids were methylated and then separated on a 30m Innowax capilliary GC column. The results were analysed by one-way ANOVA with group as a fixed effect using SPSS Statistics 24. Tukey HSD was used to determine significant differences at 0.05.

III. RESULTS AND DISCUSSION

The mean carcass weights were 13kg for the pasture group and 11.9kg for the concentrate group. The lucerne group were heavier at 18.2kg (Table1) which may result from the higher nutritional value of lucerne. All of the groups produced meat with acceptable pH at 24 hours and tenderness at 48 hours post-mortem. The lucerne and pasture groups produced darker meat than those fed concentrates. The only significant difference in the minerals was that the concentrate had less sulfur.

Table 1 Meat characteristics

	Concentrate	Pasture	Lucerne
Carcass weight	11.91^{a}	13.00^{a}	18.18^{b}
pH	5.64	5.63	5.57
Shear force	5.66^{ab}	6.58^{b}	5.29^{a}
L	42.72^{c}	39.37^{b}	36.37^{a}
a	13.23	13.78	13.01
b	12.85	12.70	11.60

Means with superscripts in the same row are significantly different at $p<0.05$.
A MIRINZ tenderometer was used to measure shear force measured in kgF.
Colour values were measured on a Hunter Laboratories Miniscan XE.

Table 2 Mineral content (µg/g)

	Concentrate	**Pasture**	**Lucerne**
Ca	79.95	71.54	70.21
Cu	1.38	1.51	1.64
Fe	20.69	19.44	19.19
K	2208	2291	2127
Mg	23.19	24.24	23.54
Mn	0.13	0.16	0.15
Na	425.1	388.3	378.4
P	2767	3027	2785
S	2707^{a}	3062^{b}	2847^{ab}
Zn	21.81	24.06	25.74

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The fatty acid profiles were dominated by C16 26%, C18 16% and C18:1 36%. The most pronounced differences in fatty acids were between the animals fed on lucerne and those on concentrates. Those fed on concentrates had a higher proportion of saturated fatty acids, particularly C16:0 and shorter chain lengths, and more 18:3n-6. The fat from those animals fed on lucerne had a healthier profile with less of these unfavourable fatty acids and higher levels of the omega 3 fatty acids with significant increases in 18:3n-3 and 22:5n-3 (DPA). The animals fed on pastures had an intermediate profile. Feeding on concentrates for six weeks may not have been long enough to see differences between pasture and concentrates.

Table 2 Lipid content

	Concentrate	**Pasture**	**Lucerne**
C10:0	0.24	0.25	0.25
C12:0	0.31	0.29	0.19
C14:0	4.23^{b}	3.60^{b}	2.31^{a}
C14:1n-5	0.15^{b}	0.11^{b}	0.05^{a}
C15:0	0.42^{b}	0.37^{b}	0.27^{a}
C16:0	27.19	25.35	24.66
C16:1n-7	1.61^{b}	1.49^{b}	1.13^{a}
C17:0	1.13^{b}	0.92^{a}	0.89^{a}
C17:1n-7	0.71^{b}	0.65^{ab}	0.55^{a}
C18:0	15.55	16.24	16.66
C18:1	35.26	35.57	36.50
C18:2n-6	5.77	5.30	6.80
C18:3n-6	0.41^{b}	0.40^{b}	0.29^{a}
C18:3n-3	1.16^{a}	2.13^{b}	2.91^{c}
C20:0	0.37	0.28	0.21
C20:4n-6 (AA)	1.63	1.61	1.91
C20:5n-3 (EPA)	1.07	1.37	1.74
C22:2n-6	1.50	1.55	1.52
C22:5n-3 (DPA)	0.92^{a}	1.25^{ab}	1.59^{b}
C22:6n-3 (DHA)	0.33	0.35	0.43
SFA	**49.45^{b}**	**47.29^{ab}**	**45.44^{a}**
MUFA	**37.73**	**38.74**	**37.37**
PUFA	**12.80**	**13.96**	**17.19**

Abbreviations: AA arachidonic acid, DHA docosahexaenoic acid, DPA docosapentaenoic acid, EPA eicosapentaenoic acid, MUFA monounsaturated fatty acids, PUFA polyunsaturated fatty acids, SFA saturated fatty acids.

IV. CONCLUSION

This confirmed that diet influenced the fatty acid profile of these lambs. Feeding lambs on lucerne decreased the proportion of saturated fatty acids, increased the omega 3 fatty acids in meat and shifted the fatty acid profile towards that recommended by health agencies.

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