

Influence of season and finishing diet on the fatty acid composition of lamb longissimus dorsi muscle

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Introduction The fatty acid (FA) composition of ruminant meat is influenced by many aspects of the production system including the animal finishing diet. Lamb produced from grass-fed animals contains greater concentrations of long-chain (LC) n-3 polyunsaturated fatty acids (PUFA) than lamb produced from concentrate-fed animals (French *et al*, 2000). Since the animal diet is likely to vary over the farming year (McAfee *et al*, 2009), it is possible that the season of animal slaughter will also influence quantities of LCn-3 PUFA found in meat and subsequently available for human consumption. The aim of this study was to determine the FA composition of lamb produced in Northern Ireland, examining the effects of both season of slaughter and reported finishing diet.

Methods Samples of lamb longissimus dorsi (LD) muscle (n= 217) were collected fortnightly from a commercial abattoir over a 12 month period. Producers were identified and contacted to obtain information on whether the finishing diet provided in the month prior to slaughter was grass, concentrates, grass supplemented with concentrates or silage supplemented with concentrates. Total lipid was extracted from lean tissue according to the Folch method (Folch *et al*, 1957) and FA methyl esters were analysed using gas chromatography. Principle components analysis (PCA) was performed on the proportional FA data (% w/w) to investigate the influence of season and reported finishing system on FA profiles. To analyse for the effect of season and diet, a factorial ANOVA (SPSS v. 11.5) was used including season and diet as well as their interaction as fixed effects. Bonferroni post hoc test was used to adjust for multiple comparisons. Seasons defined as Spring: March – May; Summer: June-August; Autumn: September – November; Winter: December – February.

Results The intramuscular fat content of the LD muscle was not significantly affected by season. Lamb finished in summer had significantly higher concentrations of LCn-3 PUFA and total conjugated linoleic acids (CLA) than any other season ($P < 0.05$ for docosapentaenoic acid (C22:5n-3) ($P < 0.01$) in lamb slaughtered in summer. This interaction showed that in summer animals that were reported to be finished on grass had higher concentrations of this LCn-3PUFA compared to those finished on concentrates alone or on silage supplemented with concentrates. PCA analysis explained 74% of total FA variation (PC1 41%, PC2 33%). The PCA scores plot (Fig 1) showed that samples of LD muscle from lamb produced in summer (▲) were grouped mainly in the lower half section. The loadings plot showed that summer produced lamb was associated with lauric acid, myristic acid, palmitic acid, palmitoleic acid, CLA c9, t11 isomer, linoleic acid (C18:2n-6), alpha-linolenic acid (C18:3n-3), arachidonic acid (C20:4n-6) and eicosapentaenoic acid (C20:5n-3). There is no clear separation between the other seasons on the PCA scores plot (Fig 1).

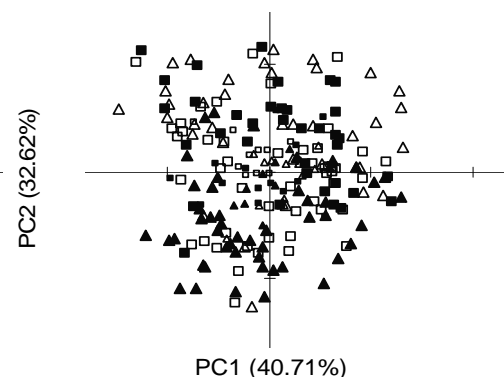


Figure 1 PCA scores plot for FA analysis.
 ▲ Spring; ▲ Summer; □ Autumn; ■ Winter.

Conclusions Results of this study provide evidence that there is seasonal variation in the concentration of a number of FA in lamb produced under a range of commercial production systems. The higher concentrations of LCn-3 PUFA and total CLA in summer-produced lamb may have potential benefits for consumer health. Further research is needed however, to determine the time course of these changes in order to optimise conversion of the C18:3n-3 from grass to LCn-3 PUFA in the lamb muscle.

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