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EFFECT OF GRAIN-BASED VERSUS FORAGE-BASED FEEDING PRACTICES ON THE CONJUGATED LINOLEIC ACID CONTENT OF LAMB

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Introduction

Lamb per capita consumption has been relatively constant over the past several years, representing less than one half of a percent of the total per capita consumption (AMI, 2003). With poultry, seafood, and red meat per capita consumption at 221 lbs., there appears to be opportunity for the lamb industry to capture a bigger portion of the consumer's plate.

Lamb is positioned to take advantage of the current trends surrounding consumer preference toward food products raised under natural conditions with beneficial nutritional attributes. For example, there appears to be considerable interest in the potential health benefits of ruminant, grass-fed animal products versus grain fed products. Chin et al. (1994) reported that ruminant derived animal products contained higher levels of conjugated linoleic acid (CLA), a fatty acid isomer that has been reported to have potential human health benefits. Such benefits include anticarcinogenic (Ip et al., 1994; Parodi, 1994; Visonneau et al., 1997) as well as antidiabetic (Houseknecht et al., 1998) effects.

In particular, grass-fed, beef and dairy products appear to be higher in conjugated linoleic acid relative to food products raised under other feeding practices (Stanton et al., 1997; Kelly et al., 1998; French et al., 2000; Poulson et al., 2004; Noci et al., 2005). While there appears to be an increasing pool of knowledge surrounding beef and dairy products, much less is known regarding the health benefits of lamb, specifically the concentration of conjugated linoleic acid.

Objectives

The objective of this study was to determine the effect of grain-based versus forage-based feeding practices on the conjugated linoleic acid content of lamb.

Methodology

Twenty-three crossbred, wether lambs from the California State University, Chico Agricultural Teaching and Research Center were randomly assigned to one of two finishing diets (grain-based or forage-based) across three sire breed types (Silverdale, White Dorper, and Blackface) post-weaning. The grain-based diet consisted primarily of corn supplemented with alfalfa hay at a rate of 39% while the forage-based diet consisted

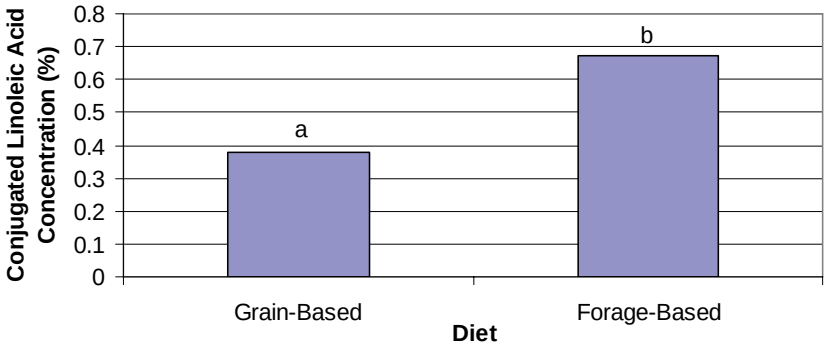
primarily of alfalfa hay supplemented with almonds hulls at a rate of 18%. Lambs were maintained on a raised floor facility in diet X breed treatment groups during the finishing phase of the trial. Animals in all treatment groups had ad libitum access to feed and water. Lambs were harvested at a constant backfat of .16 in. as determined by real-time ultrasound (Aloka 500) between the 12th and 13th ribs. All lambs were processed through a federally inspected plant. At fabrication of each lamb carcass, *longissimus* muscle was obtained from matching locations (post-12th rib) from each lamb, aged 14 d at 34º C, and then frozen until the lipid analysis.

Prior to lipid extraction, *longissimus* samples were thawed and ground. Lipids were extracted from lamb samples in triplicate using a modified version of the Stanton et al. (1997) procedure. Lipid extraction included three phases: sample preparation and lipid extraction, lipid separation, and methylation of total fatty acids with sodium methoxide. Conjugated linoleic acid (cis-9, trans-11-18:2; CLA) concentration of each *longissimus* sample was then determined using gas chromatography using procedures described by French et al. (2000). Data were analyzed using ANOVA as a 2X3 factorial, fitting diet and sire breed as main effects (Statistix 8, 2003).

Results & Discussion

The CLA content of lamb finished on a forage-based diet was significantly higher (p=.0256) compared to lamb finished on a grain-based diet (Figure 1). Forage-finished lamb appeared to be .34% higher in CLA content compared to grain-finished lamb. Nuernberg et al. (2001) found similar findings, reporting enhanced CLA concentrations in pasture-fed lamb. Similarly, Aurousseau et al. (2004) reported that grass fed lamb was preferred compared to stall fed lamb from a human health perspective due to its higher concentration of CLA. Researchers also found grass fed lamb exhibited a more favorable omega-6 to omega-3 ratio.

Figure 1. Effect of feeding practice on conjugated linoleic acid concentration of lamb



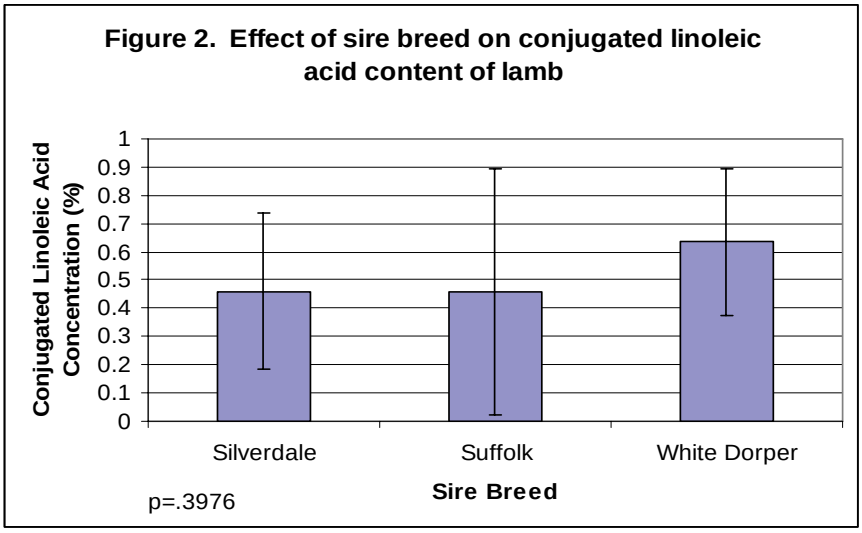
[a,b]Diets without common superscripts differ (p<.05).

Similar trends have been found in beef and dairy products. French et al. (2000) reported favorable fatty acid profiles for beef fed forage-based rations relative to those with higher levels of concentrates. Researchers reported higher concentrations of

polyunsaturated fatty acids, lower concentrations of saturated fatty acids, more favorable omega-6:omega-3 ratio, and increased CLA as the forage content of rations increased. Similarly, Poulson et al. (2004) reported that beef raised on forage and pasture exhibited enhanced CLA concentrations. Stanton et al. (1997) and Kelly et al. (1998) both reported that the inclusion of forage in the diet of dairy cows increased the CLA content of milk. Research suggests that the inclusion of forage appears to improve the CLA concentration in ruminant animal products.

Sire breed (Figure 2) did not appear to have a significant effect on CLA content of lamb finished on forage versus grain, nor was there a significant diet X breed interaction ($p>.05$). Demirel et al. (2004) also investigated breed effects along with the addition of polyunsaturated fatty acids to diets as potential factors influencing CLA concentration in lamb; as with the present study, breed did not appear to be a significant source of variation. However, researchers did find that adding polyunsaturated fats to diets enhanced CLA concentrations in lamb meat.

Figure 2. Effect of sire breed on conjugated linoleic acid content of lamb



Conclusions

Results suggest that the conjugated linoleic acid profile of lamb may be improved from a human health perspective when forage is included in finishing diets of lamb. However, further research is needed to investigate potential sire breed effects on the CLA content in lamb *longissimus* muscle.

Acknowledgements

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