Chapter 2.

Effect of Omega-3 Enriched Supplements, Sire Breed and Sex on Growth and Body Conformation Traits

Abstract

The use of canola and rice pollard oils in sheep supplements has come under particular focus recently. This is largely due to the rich source of omega-3 (ω-3) polyunsaturated fatty acids (PUFA) they contain and the associated health benefits in retinal and brain development as well as minimising the risks of susceptibility to arteriosclerosis, coronary heart disease, obesity and hypertension. Therefore, the objective of this study was to investigate the effect of canola and rice pollard oil on growth and body conformation traits of sheep run under on-farm conditions. It was hypothesised that supplementing sheep under on-farm conditions with canola and rice pollard oil will improve the liveweight traits. Conducted under on-farm conditions on the North-West coast of Tasmania, 96 lambs balanced by sire breed (Black Suffolk and White Suffolk) and sex (ewes and wethers), were randomly allocated to the following four dietary treatment groups: control (pasture only), no oil (pasture plus non-oil finishing pellet), pasture plus canola oil finishing pellet, and pasture plus rice pollard oil finishing pellet. Supplementary fed lambs were group-fed at an average rate of 1 kg/head/day for 68 days, a 21-day adjustment period inclusive. Changes in liveweight (LWT), average daily gain (ADG), body condition score (BCS) and chest girth (CG) were recorded weekly. Data was analysed in SAS using repeated measures analysis of variance in general linear models procedures to test for the fixed effects of dietary treatment, sire breed, sex and their second order interactions on dependent variables. There were significant (P<0.05) dietary (LWT, ADG, BCS, CG), sire breed (LWT and ADG) and sex (BCS) effects on lamb growth and body conformation responses. Specifically, the canola oil supplement elicited the highest changes in LWT (7.7 kg), ADG (163.8 g/d), BCS (1.3) and CG (16.2 cm) compared to the pasture-fed (control) group of lambs with the lowest performance (4.3 kg LWT; 92.1 g/d ADG; 0.7 BCS and 12.3 cm CG). This study also found that canola oil supplements can be used without any negative effects on growth and body conformation compared to a conventional (non-oil) finishing pellet.

Chapter 3.

Effect of Omega-3 Enriched Supplements, Sire Breed and Sex on Wool Growth and Quality Traits

Abstract

Dietary nutrients, particularly amino acids from protein-rich sources, are partitioned in the sheep between muscle growth and fine wool synthesis. Achieving a balance, whereby lamb growth rates are maximised, without detrimental impacts on wool quality is key in dual-purpose sheep production systems. This experiment tested the hypothesis that nutrient partitioning of dietary omega-3 (ω-3) rich oil supplements in a typical on-farm pasture based management system will not be detrimental to wool quality. Therefore, the aim of this study was to evaluate the effect of supplementing lambs with canola and rice pollard oil pellets, the sire breed and sex on wool quality traits in an on-farm pasture-based management system. Ninety-six lambs sired by White Suffolk and Black Suffolk rams mated with Coopworth ewes were randomly allocated into 4 treatments – the control group grazing on pasture without any supplements; pasture plus non-oil containing pellets; pasture plus canola oil pellets and pasture plus rice pollard oil pellets. Supplemented lambs were group-fed 1kg/head/day for 68 days including a 21-day adjustment period. Wool samples were analysed and the results demonstrated that differences in wool quality between the control and supplemented groups were not significant ($P>0.05$). However, sire breed significantly ($P<0.05$) influenced comfort factor (CF) while sex had a significant ($P<0.05$) impact on fibre diameter (MFD), spinning fineness (SF) and CF. Black Suffolk sired lambs had a 4% higher CF than the White Suffolk sired lambs. Wethers grew higher quality wool than ewes. This study conclusively demonstrates that ω-3 rich canola and rice pollard oil pellets can be used an as alternative supplementary feed source for lambs without compromising wool quality on-farm**.**

Chapter 4.

Effect of Omega-3 Enriched Supplements, Sire Breed and Sex on the Meat Fatty Acid Profile of Lambs

Abstract

Strategic nutritional manipulation of meat quality entails intensively managing lamb fatty acid (FA) composition as it influences sensory eating attributes such as flavour, appearance and shelf-life. This component of the study investigated the impact of on-farm supplementation of grazing lambs with pellets that contained oil from either canola or rice pollard or non-oil finishing pellets, sire breed and sex on the FA composition and content of the *Longissimus dorsi* muscle. The primary objective was to investigate if supplemented lambs can provide a source (30 mg/100 g) or good source (60 mg/100 g) of the health-promoting and essential omega-3 long-chain polyunsaturated (ω-3 LC-PUFA) FA. Post-slaughter *Longissimus dorsi* muscle samples were taken from F_1 ewe and wether lambs sired by Black Suffolk and White Suffolk rams joined to Coopworth ewes and analysed. Supplemented lambs had more total PUFA (ΣPUFA) (ranging from 220 mg/100g in the non-oil treatment to 259 mg/100g in the canola and rice pollard oils) than the control lambs grazing pastures only (180 mg/100g). Similar trends of increases in total omega-3 PUFA (Σω-3 PUFA), total long-chain omega-3 PUFA (Σω-3 LC-PUFA) and docosapentaenoic acid (DPA 22:5 ω-3) were observed with supplementation. It was also apparent that the Σω-3 LC-PUFA content in all lambs attained the minimum 'source levels' of 30 mg/100g that ranged from 35 mg/100g in the control treatment to 48 mg/100g in the rice pollard oil group. However, the influence of sire breed and sex on individual FA proportions (% total FA) and totals of saturated (SFA), monounsaturated (MUFA), ω-3 and ω-6 PUFA did not show significant variations and were, for the most part, negligible. These results suggest that the attainment of 'source levels' of the health-beneficial ω-3 LC-PUFA is achievable in grazing lambs by supplementing with rice pollard and canola oils. Thus, lamb and its associated nutritional and sensory qualities can be enhanced on-farm through nutritional management.