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Effect of concentrate supplementation at pasture and inclusion of condensed tannins (Quebracho) in concentrates on lamb performance and faecal egg and worm counts

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ABSTRACT

Two studies were undertaken to evaluate the effect of concentrate supplementation at pasture and inclusion of Quebracho on the performance and faecal egg counts of lambs grazing a perennial ryegrass sward from six weeks of age until 5 months of age or slaughter. In experiment 1, from six weeks of age until weaning, lambs were offered no concentrate (NC), low protein (130 g metabolisable protein (MP)/kg dry matter (DM)) concentrate (LP) or high protein (160 g MP/kg DM) concentrate (HP). From weaning until slaughter, lambs were offered 500 g/day of LP or HP concentrate containing either zero Quebracho (T0) or 80 g Quebracho/kg fresh (T80). Prior to weaning, lambs offered LP or HP concentrate had significantly greater weaning live weights (LW), liveweight gains (LWG) from birth to weaning and reduced age at slaughtered compared to those offered NC ($P<0.001$). Protein level had no effect on lamb performance. Lambs offered NC in the pre-weaning period had higher LWG from weaning to the end of the study relative to lambs offered LP and HP concentrate. In the post-weaning period, protein content of the concentrate had no significant effect on age at the end of the study, LWG from birth to the end of the study or carcass characteristics. There was a significant interaction between protein content and level of tannin inclusion on LWG from weaning to the end of the study. Lambs offered LP/T0 concentrate had lower LWG than those offered LP/T80, HP/T0 or HP/T80 concentrates ($P<0.01$). Pre and post-weaning treatment had no significant effect on Strongyle faecal egg counts or total worm counts in the abomasum or small intestine. In experiment 2, from six weeks of age until slaughter, lambs were offered no concentrate (NC), concentrates containing zero Quebracho (LP/T0), concentrate plus 80 g Quebracho/kg fresh (LP/T80) and concentrate plus 100 g Quebracho/kg fresh (LP/T100). The concentrate contained 130 g MP/kg DM. Relative to NC treatment, concentrate supplementation increased lamb LWG from birth to weaning and from birth to the end of the study and reduced age at slaughter ($P<0.01$). Increasing level of tannin inclusion had no significant effect on lamb performance, faecal egg counts or total worm counts in the abomasum and small intestine. Overall in the study faecal egg counts were low and worm counts taken from slaughtered animals were less than 3000 worms per animal. The results of this work indicate that supplementing lambs with concentrates at pasture improved animal performance, but concentrate supplementation and inclusion of Quebracho had no effect on faecal egg counts.

1. Introduction

Concentrate supplementation of animals at pasture is used to maintain animal performance when herbage availability is low or to improve performance levels of animals grazing high

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quality pasture. A number of studies have evaluated the effect of supplementing ewes with concentrates at pasture on lamb performance (Young et al., 1980; Milne et al., 1981; Penning et al., 1988). However only a few studies have examined the effect of concentrate supplementation or composition of the concentrate on the performance of grazing lambs (pre- or post-weaning). Prache et al. (1990) examined the interaction between herbage availability and concentrate supplementation on lamb performance up to weaning and observed that at low herbage availability, supplementation increased lamb growth rate by 61 g/day but had no effect at the high herbage allowance. Grennan and O'Riordan (1996) observed an increase in lamb weaning live weight of 0.23 kg/kg concentrate offered, while in a subsequent study, after weaning, supplementing with 300 g concentrate/day reduced days to slaughter by 27 days (Grennan, 2005). No known studies have evaluated the effect of protein content of concentrates on lamb performance, although Penning et al. (1988) reported an improvement in lamb growth rate when ewes were provided with concentrates containing protein of lower rumen degradability. On this basis, the first objective of the current study was to evaluate of the effect of concentrate supplementation and protein content of the concentrate on lamb performance at pasture.

In addition to consequences on animal performance, concentrate supplementation is likely to have an effect on the level of parasitism in susceptible, undernourished animals mediated through an effect on protein (Donaldson et al., 1998) and/or energy (Knox and Steel, 1999) supply. The role of nutrition as a mechanism to control parasites has assumed greater importance in recent years, as the long-term sustainability of frequent drenching with anthelmintics has been questioned in view of the increasing prevalence of strains of roundworms which have developed resistance to one or more classes of drugs (e.g. Waller, 2003). In addition to manipulating the protein and energy content of the diet, the administration of certain plant secondary compounds such as condensed tannins (Athanasiadou et al., 2000a) have been evaluated as a mechanism to control worm burdens. However, many of the latter studies have been undertaken under controlled conditions where lambs are artificially infected with worms and drenched with the condensed tannins or protein supplement. No known research studies on the impact of these treatments under more natural grazing conditions are available. Therefore, on this basis the second objective of the current study was to evaluate the effect of concentrate supplementation and protein and tannin content of the concentrates on faecal egg counts of lambs on grass-based systems.

2. Material and methods

2.1. Animals and management

In Experiment 1, 149 crossbred ewes (Blue-faced Leicester × Blackface, Texel × Blackface, Suffolk × Cheviot, Texel × Cheviot and Texel × Greyface) and 233 lambs (sired by Texel, Beltex and Suffolk) were used. Mean lambing date was 7 April and the average live weight and age of the lambs at the start of the study was 16 ± 4.9 kg and 34 ± 8.2 days.

In Experiment 2, 128 crossbred ewes (Texel × Greyface, Blue-faced Leicester × Blackface, Texel × Blackface, Suffolk × Cheviot, and Texel × Cheviot) and 187 lambs (sired by Texel, Suffolk, Lleyn and Charollais) were used. Mean lambing date was also 7 April and the average live weight and age of the lambs at the start of the trial was 17 ± 4.2 kg and 36 ± 7.5 days.

In both studies, ewes and lambs grazed perennial ryegrass swards and were managed as one group until the imposition of the experimental treatments.

2.2. Treatments and experimental design

2.2.1. Experiment 1

In May 2003, ewes and lambs were given injectable moxidectin (1% w/v), as nematodirus eggs were detected in the faeces, and were allocated to one of three pre-weaning concentrate treatments balanced for lamb breed, lamb sex and numbers of singles/twins/triplets. Three pre-weaning dietary treatments were offered. These consisted of no concentrate supplementation (NC) (49 ewes and 77 lambs), supplemented with concentrates formulated to yield 130 g metabolisable protein (MP)/kg DM (low protein (LP)) (50 ewes and 78 lambs) and supplementation with concentrates formulated to yield 160 g MP/kg fresh (high protein (HP)) (50 ewes and 78 lambs). Pelleted concentrates were offered to lambs through a creep concentrate feeder. The HP concentrate consisted of 350, 200, 100, 300, 25 and 25 g/kg fresh of barley, sugar beet pulp, maize meal, soya bean, minerals/vitamins and molasses. The LP concentrate consisted of 400, 250, 200, 100, 25 and 25 g/kg fresh of barley, sugar beet pulp, maize meal, soya bean, minerals/vitamins and molasses. The grazing area was divided into three plots so that there was one treatment per plot and the treatments were imposed for 65 days until weaning (average age 99 ± 8.1 days). At weaning, lambs were given an oral dose of an ivermectin based anthelmintic (0.08% w/v) and lambs within each of the pre-weaning treatments were allocated to one of four post-weaning treatments balanced for pre-weaning treatment, lamb breed and lamb live weight gain from the start of the trial until weaning. The four post-weaning treatments consisted of supplementation (500 g/head/day) with LP or HP concentrates containing either zero Quebracho (T0) or 80 g Quebracho extract/kg fresh weight of concentrate (T80) i.e. two protein levels × two levels of tannin inclusion (57 lambs per treatment). The lambs remained on the same pasture as in the pre-weaning period with the four areas at right angles to those used in the pre-weaning period. The grazing area used for the experiment was chosen to supply sufficient grass for the sheep throughout the grazing period and sward height was maintained between 5 and 7 cm. At the start of the experiment, an area was fenced off for the experimental animals. Non-experimental sheep, which were also treated with anthelmintic, grazed outside this area to maintain sward heights between 5 and 7 cm as this part of the plot would be used later on in the study. As the season progressed, the experimental area was increased and non-experimental animals were removed. In the pre-weaning and post-weaning periods there was one treatment on each experimental grazing area i.e. treatments were not replicated across a number of plots. Post-weaning treatments were imposed until the lambs reached 40 kg live weight (females) or 46 kg live weight (males). The experiment was terminated when animals had been offered the post-weaning