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Sporidesmin poisoning in ewes during late pregnancy

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ABSTRACT

Recent interest in mating ewes at non-traditional times has increased the risk of sporidesmin poisoning (facial eczema) during mid to late pregnancy and lactation. In this pilot study, autumn mated ewes dosed with sporidesmin during pregnancy were used as a model to study the effects of sporidesmin poisoning on production. Ninety ewes were randomised into 3 equal sized groups and were dosed with either a low (0.125 mg/kg live weight) or moderate (0.250 mg/kg) dose of sporidesmin at 120± 7d of gestation. Control ewes were undosed.

Dosing resulted in elevated serum gamma glutamyltransferase (GGT) levels in the ewes but not the lambs. Dosing with 0.125 and 0.250 mg sporidesmin/kg live weight elevated group mean GGT levels by about 40 and 110 iu/ℓ respectively 24 d after dosing. Twenty five days later when lambing was complete, GGT levels were further increased by about 40 iu/ℓ. Most of this increase appeared to be associated with lambing and lactation as the undosed ewes showed a similar increase. Increasing dosage of sporidesmin was associated with decreasing ewe survival (100% *v* 98% *v* 89% $P<0.05$), reduced lamb birth weight (4.6 *v* 4.5 *v* 4.2 kg $P<0.05$), docking weight (8.0 *v* 7.6 *v* 6.8 kg $P<0.01$)), weaning weight (18.6 *v* 17.6 *v* 17.1 kg $P<0.1$) and lamb survival (91% *v* 82% *v* 69% $P<0.05$). Ewe live weight, fleece weight, lambing date and milk production were not affected by treatment.

The cost of a minor facial exzema outbreak in an autumn lambing flock is estimated from data in this trial, to be about 30% fewer kg lamb weaned per ewe pregnant plus 12% fewer ewes present at weaning. These losses are about 2 to 3 times those reported for ewes following a field challenge of sporidesmin around the time of mating. The risks of sporidesmin poisoning and lost production must be considered in managing autumn lambing systems. These results highlight the need for cost effective control programmes.

Keywords Sporidesmin; gamma glutamyl transferase; pregnancy; live weight; wool production; survival.

INTRODUCTION

The adverse effects of facial eczema outbreaks during mating on ewe productivity have recently been quantified (Smeaton *et al.*, 1985; Knight *et al.*, 1983). In these studies the ewes were coincidentally mated and poisoned during the autumn. Recent interest in mating ewes at non-traditional times has increased the risk of sporidesmin poisoning during mid to late pregnancy and lactation. As there is no published information on the production consequences of sporidesmin poisoning during these physiological states, the aim of this trial was to estimate production losses associated with sporidesmin poisoning in late pregnancy.

MATERIALS AND METHODS

Autumn mated ewes were dosed with sporidesmin toxin at about 120 d of gestation to model farming systems in which November mated ewes are challenged by toxin in early March with lambing occurring in April.

Ninety Romney ewes, pregnant to matings over 14 d, were allocated to 3 equal sized groups after balancing for expected litter size. Two sporidesmin dose rates, 0.125 and 0.250 mg/kg predose live weight, were used to ensure a wide range in the severity of sporidesmin intoxication and to provide groups with either moderate or moderately severe symptoms of facial eczema. These dose rates were expected to induce liver damage in about 55% (40-65%) and 95% (80-100%) (95% CI) of the ewes in each group respectively (N.R. Towers, unpublished). The sporidesmin was administered orally on each of 2 consecutive days in early August. Serum gamma glutamyltransferase (GGT) values were determined on samples collected before dosing, 2 and 3 weeks later, and 2, 5 and 10 weeks after the middle of lambing. Ewe live weights were recorded before dosing (28 July), pre-lambing (17 August) and at weaning (26 November). Lambs were weighed at birth, docking (18 September) and weaning (26 November). Ewe and lamb survival rates to weaning and fleece weights at weaning were recorded. A sample of 6 ewes rearing single lambs from each of the 3 treatment groups were used to assess milk production at about 3 weeks post-lambing using the oxytocin and milking procedures developed by McCance (1959).

Binomial data were analysed by standard

statistical procedures following logit transformation. GGT data were skewed in distribution and a $\log_e$ transformation was applied prior to analysis of variance. The GGT values presented are the back-transformed (geometric) means.

RESULTS

GGT

Pre-dose levels were within the normal range in the 3 treatment groups (mean = 34 iu/ℓ plasma). Dosing resulted in an elevation of GGT levels in ewes but not lambs. Dosing with 0.125 and 0.250 mg/kg elevated group mean GGT levels by about 40 and 110 iu/ℓ plasma ($P<0.001$) respectively 24 d after dosing (Fig. 1). Twenty five days later when lambing was complete, GGT levels peaked another 40 iu/ℓ higher in the 3 groups ($P<0.001$). GGT levels declined in a linear manner from the peak to weaning. However, GGT levels at weaning in dosed ewes tended to remain elevated above pre-dose levels ($P<0.05$).

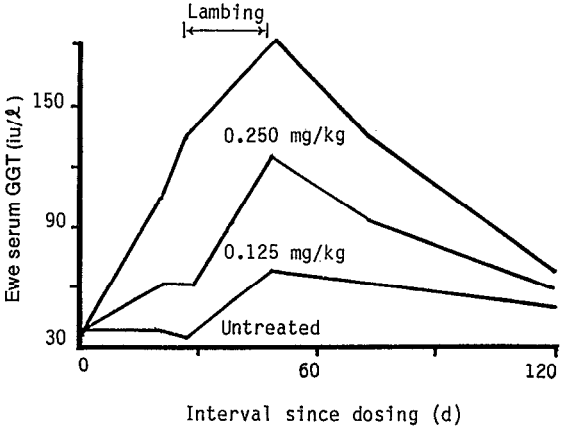

FIG. 1 Pattern of serum gamma glutamyl transferase (GGT) concentration following dosing with sporidesmin.

Lamb GGT levels were very high at birth and declined slowly to normal levels by weaning (Table 1). Ewe dosing treatment tended to elevate birth GGT levels (290 *v* 460 *v* 545 iu/ℓ NS).

TABLE 1 Production losses associated with 100 iu/ℓ GGT increase above normal in ewes.

Production trait	Production loss
Ewe weaning weight (kg)	3
Ewe fleece weight (kg)	0.12
Ewe survival (%)	2
Lamb wean weight (kg)	1.5
Lamb survival (%)	6

Live Weight

Ewes averaged 52 kg live weight at dosing with dosed ewes tending to subsequently lose more weight by docking (52.9 *v* 51.1 kg NS) and weaning (47.8 *v* 47.0 kg NS) than undosed ewes. Serum GGT levels 3 weeks after dosing were related to subsequent weight loss to the extent that increases of 100 iu/ℓ above pre-dosing levels were associated with losses of 3 to 4 kg in ewe live weight at docking and weaning (Table 1). A further increase of 100 iu/ℓ is associated with a further 1 to 1.5 kg reduction in ewe live weight.

Compared with undosed groups, dosing resulted in lower lamb birth weights (4.6 *v* 4.5 *v* 4.2 kg $P<0.05$), docking weights (8.0 *v* 7.6 *v* 6.8 kg $P<0.01$), weaning weights (18.6 *v* 17.6 *v* 17.1 kg $P<0.1$) and pre-weaning gain (13.9 *v* 13.1 *v* 13.1 kg $P<0.1$). A 100 iu increase in dam GGT over baseline resulted in lambs weighing 1.5 kg less at weaning (Table 1).

Survival

Dosing resulted in fewer ewes (100 *v* 98 *v* 88 $P<0.05$) surviving to weaning. Furthermore, most of the ewe treatment differences could be explained by differences in GGT levels 3 weeks after dosing. A 100 iu increase in ewe GGT decreased ewe and lamb survival by 2 and 6% respectively (Table 1).

Fleece Weight, Milk Production and Lambing Date

Fleece production from May to November was similar in the 3 treatment groups (1.79 *v* 1.78 *v* 1.85 kg $P<0.1$). Serum GGT levels 3 weeks after dosing were associated with differences in individual ewe fleece weight ($P<0.05$). Thus, increases in ewe GGT by 100 iu/ℓ above pre-dosing levels were associated with 0.11 kg lighter fleeces. An additional 100 iu/ℓ increase was associated with another 0.05 kg reduction.

Ewe treatment group had a small effect on lamb fleece weight (0.80 *v* 0.78 *v* 0.76 kg $P<0.1$), but no effect on either mean daily ewe milk production of 1.1 ml/min or mean lambing date of 24 August.

DISCUSSION

These findings highlight subclinical facial eczema as a major source of production loss in pregnant and or lactating ewes. This loss in productivity was manifested as lower ewe and lamb survival rates, live weight and fleece production.

Post-lambing ewe and lamb losses are a feature of severe sporidesmin poisoning during the mating season (Southey *et al.*, 1986). Other research results indicate no effect on lamb survival in spring lambing

ewes (Smeaton *et al.*, 1985; Moore *et al.*, 1983; Sheath *et al.*, 1987). Differences in severity of intoxication could account for different outcomes in these studies. Ewe deaths in the present study occurred between lambing and weaning. As with lamb deaths, they did not appear to be concentrated during any 1 time interval after lambing. The large majority of ewe deaths were not associated with any clinical symptoms.

Clearly, sporidesmin intoxication in some way seriously compromises the welfare of lactating ewes. The association of increased deaths with increased GGT levels suggests that the compromised liver was unable to meet the increased demands of lactation.

No lambs exhibited clinical facial eczema lesions. The neonatal rise in lamb GGT was probably a result of transfer of colostral GGT to suckling lambs. Several authors have reported high serum GGT levels in lambs and calves ingesting colostrum, and vice versa (Pauli, 1983; Braun *et al.*, 1982; Thompson and Pauli, 1981). It is difficult to fully explain the increase in lamb death rate in the dosed groups, although some deaths were a consequence of early post-lambing ewe death. Inadequate milk production did not appear to be a feature of sporidesmin poisoning in this study.

The pattern of rise in serum GGT in dosed ewes is largely consistent with previous findings under field challenge (Towers, 1986; N.R. Towers, unpublished) and dosing (Towers and Stratton, 1978) with maximum GGT levels occurring after about 3 weeks followed by a slow decline to normal. The proportion of dosed ewes with elevated GGT levels was as expected. This indicates that ewes in early and late pregnancy have a similar tolerance to sporidesmin.

The post-lambing increase in serum GGT observed in control and dosed ewes has not previously been reported. In dairy cattle, Blackshaw (1978) has reported higher mean GGT levels in early lactation (7 samples out of 88). This elevation was ascribed to "heavy lactation exacerbating previously dormant liver damage". In the control ewes in this study, only 1 failed to register on elevation in post-lambing GGT level. Presumably lambing and/or early lactation causes GGT loss from tissue to blood.

Although there was little difference in group mean ewe live weight, there was a major effect of liver damage (as assessed by serum GGT) on individual ewe live weight The nature of this relationship illustrates well the risk individual ewes face when GGT levels are elevated 100 iu above normal. Unless the 3 to 4 kg loss in live weight is regained by the subsequent mating, further fleece and lamb production losses would be anticipated. Other workers have indicated that production loss associated with subclinical facial eczema in autumn mated ewes is lower than in this study (Smeaton *et al.*, 1985; Moore *et al.*, 1983; Knight *et al.*, 1983; Sheath *et al.*, 1987).

Lamb weights tended to be adversely affected by ewe dosage treatment. Furthermore, elevations in individual ewe GGT were associated with reductions in lamb performance. This relationship was strongest at birth and declined considerably by weaning. This effect was unlikely to be a function of milk production since this was similar in early lactation in all groups.

Further production losses were associated with liver injury since fleece weights were depressed. Ewes challenged during the autumn when wool growth rate is higher may show a greater depression.

Clearly, sporidesmin intoxication in some way seriously compromises the welfare of pregnant and/or lactating ewes. The association between lowered performance and increased GGT level suggests that impaired liver function resulting from the sporidesmin-induced damage contributes to this poorer performance. Direct effects of sporidesmin on the performance of the foeto-placental unit cannot be ruled out.

CONCLUSIONS

The cost of a moderate sporidesmin poisoning in ewes during late pregnancy is calculated to be about 30% fewer kg lamb weaned per ewe pregnant plus 12% fewer ewes present at weaning. This cost is 2 to 3 times that reported for ewes following a field challenge around the time of mating. This potential for lost productivity needs to be assessed in autumn lambing programmes and appropriate prevention and/or protection strategies implemented.

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