USE OF LASALOCID IN DIETS FED DURING SIMULATED ASSEMBLY
AND EXPORT OF LIVE SHEEP

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SUMMARY

An experiment was conducted to investigate the use of the ionophore compound, lasalocid, under conditions simulating the assembly and transport of sheep by sea. There were four dietary treatments: 0, 11, 19 and 36 g lasalocid/t. In the 5 d assembly phase animals were given 1 kg feed/d with the ratio of pellets: hay changing from 20:80 on day 1 to 100:0 on day 5. From day 6 the pelleted diet was fed ad libitum for two weeks. Measurements were made of liveweight changes, feed intake, rumen volatile fatty acids, plasma glucose and biotin. There was a dose-related increase in liveweight (P < 0.001) in response to the inclusion of lasalocid during the 5 d assembly phase, and a dose-related reduction in feed intake (P < 0.001) during the two week shipping phase. There was no significant effect on feed conversion ratio measured over the whole experiment. There was an increase in the concentration of propionate relative to acetate and butyrate in the rumen (P < 0.001). There were no significant changes in plasma glucose concentration with time or in response to dietary treatment. There was a decrease in plasma biotin concentration (P < 0.05) over the first 10 d but no treatment effect. It appears that the major effect of the ionophore in this experiment was during the adaptation to the pelleted diet.

Keywords: lasalocid, live-sheep shipping, glucose, biotin

INTRODUCTION

Over seven million sheep are exported live from Australia each year. The normal practice adopted by the industry is to assemble the sheep for export in a central feedlot where their diet is progressively changed to one consisting entirely of pelleted feed. The assembly feedlot period is a minimum of five days. Animals are then loaded onto the ships where they receive the pelleted diet for the duration of the voyage which, depending on the destination, takes between 14 and 21 days. Problems in the industry include digestive disorders associated with the rapid introduction to a pelleted diet, and disease, mainly salmonellosis. There are also deaths with no clear post-mortem diagnosis which Costa (1986) suggested may be due to hypoglycaemia. Lasalocid is an ionophore antibiotic which acts in the rumen to alter the pattern of volatile fatty acid (VFA) production towards increased propionate which may result in more efficient feed conversion. Increased propionate production is principally via succinate and not lactate, and through this pattern of fermentation the ionophore compounds can reduce the build up of lactic acid when diets high in starch are rapidly introduced (Nagaraja et al. 1981). A further consequence of higher levels of propionate production is its increased contribution to gluconeogenesis (Casson et al. 1986). The experiment reported here was designed to investigate the following aspects of lasalocid: (i) its role in the adaptation to high starch diets; (ii) its effect on feed conversion efficiency; and (iii) its possible influence on blood glucose concentration.
MATERIALS AND METHODS

There were four treatments consisting of lasalocid at approximately 0, 10, 20 and 35 g/t. The basal diet was formulated to specifications similar to those required by the industry and contained (g/kg): cereal hay (462), oats (200), barley (190), lupins (50), oat hulls (50), lime (28), urea (5), salt (5) and wheat-based premix containing lasalocid (10). Samples of feed were analysed by Roche Analytical Services (Dee Why, Australia) for lasalocid. On day 1 of the assembly phase sheep received 200 g pellets and 800 g cereal hay/head. On subsequent days the amount of pellets fed was increased by 200 g each day and the amount of hay reduced by 200 g until on the fifth day animals were fed 1 kg of pellets and no hay. During the "shipping" phase, which lasted 14 days, animals received pellets ad libitum. From a flock of 400 wethers 272 were selected on the basis of even liveweight (mean 51.2, SE 0.8 kg) and were randomly allocated to the four treatment groups. The assembly feedlotting was carried out in four outdoor paddocks where the stocking density was 4.5 m²/head. The shipping phase was conducted indoors on a slatted floor (17 sheep/pen), at a density of 0.33 m²/head. Animals were weighed at the start and end of the assembly phase and weekly thereafter. Blood samples were taken from eight animals in each dietary treatment group before each weighing in order to measure blood glucose and biotin concentrations. During the final week of the shipping phase samples of rumen fluid were taken from the same eight animals in each treatment group for the measurement of volatile fatty acids (VFA). Biotin concentrations were analysed by Roche (Switzerland). VFA were analysed by gas chromatography and glucose using a glucose oxidase-peroxidase reagent (Glu-cinet, Sclavo; Italy).

RESULTS

The diet contained (g/kg): 93 moisture, and, on a dry matter basis, 110 crude protein, 21 fat, 78 ash, 205 acid detergent fibre and an estimated metabolisable energy (ME) content of 9.5 MJ/kg. Liveweight changes are summarized in Table 1. During the assembly phase the rate of liveweight loss decreased with increasing levels of lasalocid and at the highest rate, 36 g/t, animals actually gained weight.

In the shipping phase there was a decrease in liveweight gain with increasing levels of lasalocid. Combining the data from the shipping and assembly phases there was no overall effect of lasalocid on the liveweight change over the whole experiment. The effect of lasalocid on feed intake is summarized in Table 1. During the assembly phase all sheep were offered 1 kg/head/d and consumed the total ration. During the shipping phase, when feed was available ad libitum, there was a decrease in feed intake with increasing levels of lasalocid.

Considering both the assembly and shipping phases together, there was an overall decrease in feed intake which was closely related to increasing levels of lasalocid concentration in the diet. There was no significant effect of lasalocid concentration on the feed conversion ratio measured during the shipping phase or over the whole experiment. The effect of lasalocid on the concentration of VFA in the rumen is summarized in Table 1. There were significant, dose related, reductions in the proportions of acetate and butyrate and an increase in propionate with increasing concentrations of lasalocid. There was a highly significant increase in the ratio of propionate to acetate from 0.33 in the control group to 0.65 at the highest level of lasalocid, (P < 0.01), but no effect on total concentration of VFAs.
Table 1. Effect of different levels of lasalocid in the feed on liveweight change, feed intake, feed conversion and rumen volatile fatty acids (VFA)

<table>
<thead>
<tr>
<th>Lasalocid (mg/kg feed)</th>
<th>0</th>
<th>11</th>
<th>19</th>
<th>36</th>
<th>SED</th>
<th>F-test sig.</th>
<th>Linear effect#</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liveweight gain (g/d)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembly phase</td>
<td>-281a</td>
<td>-218a</td>
<td>-189a</td>
<td>16b</td>
<td>62</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Shipping phase</td>
<td>398a</td>
<td>382a</td>
<td>367a</td>
<td>299b</td>
<td>26</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Whole experiment</td>
<td>275</td>
<td>266</td>
<td>260</td>
<td>245</td>
<td>47</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Feed intake (kg/d)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembly phase</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping phase</td>
<td>2.23a</td>
<td>1.93b</td>
<td>1.97b</td>
<td>1.76b</td>
<td>0.07</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Whole experiment</td>
<td>1.99a</td>
<td>1.75b</td>
<td>1.78b</td>
<td>1.62b</td>
<td>0.06</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td><strong>FCR (whole trial)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembly phase</td>
<td>7.41</td>
<td>6.54</td>
<td>6.76</td>
<td>6.57</td>
<td>0.49</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Shipping phase</td>
<td></td>
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<tr>
<td>Whole experiment</td>
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</tbody>
</table>

SED - Standard error of difference; NS - not significant; FCR feed conversion ratio (kg feed/kg liveweight change).

*P < 0.05, **P < 0.01, ***P < 0.001.

# Quadratic and cubic effects were not significant
+
Feed intake and FCR were calculated on the basis of air-dry feed.

The concentrations of plasma glucose measured in sheep consuming pellets without lasalocid and with lasalocid at 36 g/t were analysed and were within the range 3.5 to 4.4 mmol/L for both groups of sheep. There was no relationship between glucose concentration and time on experiment. Biotin was analysed in three sheep from each treatment group over the five sampling times. There was no effect of treatment on biotin concentration but there were differences associated with time in the feedlot. Concentrations fell from 530 ng biotin/L plasma at the start of the experiment to 373 on day 12 before rising to 480 ng/L by the end of the shipping phase (SEM = 35.8). There was no significant relationship between biotin and glucose concentrations.

DISCUSSION

The improved liveweight change of animals receiving lasalocid during the assembly phase is of particular interest. The liveweight losses observed in animals receiving unmedicated pellets were similar to those found in many assembly feedlot experiments conducted by the Western Australian Department of Agriculture (C.L. McDonald, personal communication). The reason for this rapid loss of liveweight, despite a level of energy intake which was theoretically adequate, was probably associated with clinical and sub-clinical acidosis leading to reduced contents of the gastro-intestinal tract. It is also likely that the starch in the pellets results in reduced digestion of the fibrous
fraction of the diet thus reducing the energy available to the animal. On this basis it is suggested that lasalocid could act both to reduce the build up of lactic acid in the rumen as described by Nagaraja et al (1981) and also to stabilize the pattern of rumen fermentation and thereby maintain efficient digestion of dietary carbohydrate. The fact that no improvement in feed conversion efficiency was measured in response to lasalocid in the shipping phase was possibly due to the fact that animals entered the shipping phase with different levels of gut fill. It was also a relatively short period over which to accurately measure growth rates, and the high standard error term indicates this.

The changes in the pattern of rumen VFAs with increasing levels of lasalocid were as expected for an ionophore antibiotic. The fact that plasma glucose concentrations remained normal even with the confinement of animals at a stocking density of 0.33 m²/head differs from the results reported by Costa (1986), who found a decrease in glucose concentration with time, in animals under similar experimental conditions. The reason for the difference in results between these two studies is not clear. It is interesting that plasma biotin concentrations decreased during the first two weeks following the change in diet. This could possibly be due to rapid changes in the carbohydrate supply to the small intestine causing reduced microbial synthesis of biotin (Miller et al. 1986). However, in this experiment, the reduced levels did not appear to affect gluconeogenesis to an extent where plasma glucose concentration was reduced.

It is concluded that ionophore antibiotics may provide a means of stabilizing the pattern of fermentation and digestion in sheep being prepared for the grain-based pelleted diet normally used during live export.

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REFERENCES