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Testing Intervention Strategies to Reduce the Prevalence of Lung Lesions in Lambs

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Summary

We have previously demonstrated that lung lesions decrease average daily gain in lambs. We have also observed fall born lambs have a lower prevalence of lung lesions than spring born lambs. The different prevalence in lung lesions between spring and fall born lambs suggests that lung lesions can be prevented. *Mannheimia (Pasteurella) haemolytica* and/or *Pasteurella multocida* are present in lambs with moderate or severe lung lesions, but not in lambs with normal lung tissue. In serial slaughter studies, we observed lung lesions formed post-weaning. Therefore, we designed two studies to test possible intervention strategies to reduce the prevalence or severity of lung lesions. In the first study, lambs were vaccinated against *Mannheimia (Pasteurella) Haemolytica* and *Pasteurella Multocida* at 4 and 2 weeks prior to weaning, at weaning, and 2 and 6 weeks after weaning (a minimum of 21 days before slaughter).

In the second study, lambs were fed chlorotetracycline for two weeks following weaning. All lambs had feed available ad libitum. At slaughter, lamb lungs were examined for lung lesions. Lambs were determined to have moderate lung lesions if greater than 5% but less than or equal to 50% of a lobe was consolidated and severe lung lesions if over 50% of any lobe was consolidated. Vaccination did not alter the prevalence of lung lesions (82% vs. 84% prevalence of lung lesions in vaccinated vs. not vaccinated lambs). Nor was the prevalence of severe lung lesions altered (63% prevalence of severe lung lesions in vaccinated and not vaccinated lambs). Feeding chlorotetracyline did not alter the prevalence of lung lesions (79% vs. 84% prevalence of lung lesions in chlorotetracycline fed vs. control diet) or the prevalence of severe lung lesions (58% vs. 61% prevalence of severe lung lesions in chlorotetracycline fed vs. control diet. Lambs with severe lung lesions had lower average daily gain over the entire feeding period than lambs with normal lungs or moderate lung lesions (0.55 ± 0.02 lbs/day vs. 0.66 ± 0.02 lbs/day or 0.64 ± 0.02 lbs/day, respectively. Although neither vaccination nor feeding chlorotetracycline reduced the prevalence or severity of lung lesions, these results confirm that lung lesions negatively impact sheep production by reducing average daily gain of lambs.

Introduction

Clinical respiratory disease has long been acknowledged to have negative effects on lamb production, but subclinical respiratory disease has only recently become a concern. Subclinical respiratory disease in lambs can be identified by moderate (5-50% of any lobe) or severe (>50% of any lobe) consolidation of the lungs at slaughter. We have observed that although only 8% of spring born lambs at South Dakota State University (SDSU) required individual treatment for respiratory disease, 38% (34 of 89) of the lambs had severe lung lesions, and 64% (57 of 89) of the lambs had either moderate or severe lung lesions (Daniel et al., 2006). Post weaning to finish growth performance was 0.07 pounds per day lower for those lambs diagnosed with severe lesions than moderate lesion or normal lungs (Daniel et al., 2006). Goodwin et al. also observed reduced daily weight gain during the month prior to slaughter in New Zealand lambs with greater than 20% of the lung surface area affected by lesions (2001). However, in fall born lambs at SDSU only 7% (7 of 108) of the lambs had severe lung lesions and 29% (31 of 108) had either moderate or severe lung lesions (Daniel et al., 2006). The different prevalence in lung lesions between spring and fall born lambs suggests that lung lesions can be prevented.

Mannheimia (Pasteurella) haemolytica and/or *Pasteurella multocida* are present in lambs with moderate or severe lung lesions, but not in

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lambs with normal lung tissue (Daniel et al., 2006). *Mannheimia haemolytica* and/or *Pasteurella multocida* are pathogens known to be capable of producing consolidative lesions and mild illness without clinical signs (Sharp et al., 1978). Our findings suggest that these common respiratory pathogens are present in lung lesions, and present a possible intervention target for reducing the prevalence of lung lesions.

In serial slaughter studies, we observed lung lesions formed post-weaning (Daniel et al., 2006). Therefore, we designed two studies to test possible intervention strategies to reduce the prevalence and severity of lung lesions. The objective of the first study was to determine if vaccination against *Mannheimia (Pasteurella) haemolytica* and *Pasteurella multocida* would reduce the incidence of lung lesions at slaughter. The objective of the second study was to determine if feeding low levels of chlorotetracycline at weaning would reduce the prevalence of lung lesions at slaughter.

Materials and Methods

Experiment 1: In spring of 2004, crossbred wethers (n= 76) born at the SDSU Sheep Unit were randomly assigned to either vaccinated or non-vaccinated groups. Vaccinated lambs received with an avirulent *Pasteurella Haemolytica-Multocida* live culture (Once PMH serial no. 07973836 and 07973838, Intervet, Millsboro, Delaware) and a *Pasteurella Haemolytica-Multocida* bacterin (Lamb Pneumonia Vaccine serial no. 939B, Colorado Serum Company, Denver, Colorado) at 4 and 2 weeks prior to weaning, at weaning, and 2 and 6 weeks after weaning (a minimum of 21 days before slaughter). At weaning, lambs were assigned to one of six pens depending upon vaccination treatment. All pens were in the same barn, and lambs were prevented from having nose to nose contact with lambs in other pens. Lambs had feed available ad libitum. At slaughter, lamb lungs were examined for lesions.

Experiment 2: At weaning in the spring of 2005, crossbred wethers (n = 82) born at the SDSU Sheep Unit were randomly assigned to one of six pens. All pens were in the same barn, and lambs were prevented from having nose to nose contact with lambs in other pens. Pens were fed the control diet or control diet plus 50 g/ton chlorotetracycline for two weeks following weaning. After two weeks, all pens were fed the same diet. Lambs had feed available ad libitum. Lambs were weighted every 28 days, and were slaughtered when two-thirds of the lambs were 54 kg or greater live weight. At slaughter, lamb lungs were examined for lesions. Carcass data (fat thickness at 12^{th} rib, ribeye area, and body wall thickness) were collected approximately 24 hrs after slaughter.

Lung lesion scoring: Lambs were determined to have severe lung lesions if over 50% of any lobe was consolidated. Lambs were considered to have moderate lung lesions if greater than 5% but less than or equal to 50% of a lobe was consolidated. Lambs were considered to have normal lungs if not more than 5% of any lobe was consolidated. Lungs were also examined for the presence of active abscesses or pleural adhesions.

Statistics: Effect of treatment on prevalence and severity of lung lesions were tested by Chi-square comparison. Data were also tested for effect of chlorotetracycline and lung lesion prevalence and severity on 28 day weights, average daily gain, and hot carcass weight using ANOVA and effect of chlorotetracycline and lung lesion prevalence and severity on carcass traits using ANOVA with hot carcass weight as a co-variant. All data were analyzed using SAS software (SAS Inc., Cary, NC).

Results and Discussion

Experiment 1: Vaccination did not alter the prevalence of lung lesions (82% vs 84% prevalence of lung lesions in vaccinated vs not vaccinated lambs; P = 0.76); nor was the prevalence of severe lung lesions altered (63% prevalence of severe lung lesions in vaccinated and not vaccinated lambs; P = 0.80).

Experiment 2: Treatment did not alter the prevalence of lung lesions (79% vs. 84% prevalence of lung lesions in chlorotetracycline fed vs. control diet; P = 0.55) or the prevalence of severe lung lesions (58% vs. 61% prevalence of severe lung lesions in chlorotetracycline fed vs. control diet; P = 0.75). Feeding of chlorotetracycline did not alter any growth or carcass traits relative to control fed lambs (P > 0.05). The presence of lung lesions or the severity of lung lesion did not impact any carcass traits examined (P > 0.05). Lambs with

severe lung lesions were heavier than lambs with normal lungs after the first 28 days after weaning (103.6 ± 2.2 lbs vs. 90.8 ± 6.2 lbs, respectively; P = 0.01), but lambs with severe lung lesions had lower average daily gain over the entire feeding period than lambs with normal lungs or moderate lung lesions (0.55 ± 0.02 lbs/day vs. 0.66 ± 0.02 lbs/day or 0.64 ± 0.02 lbs/day, respectively; P > 0.02).

Based on these results, it does not appear vaccination against *Mannheimia (Pasteurella) haemolytica* and *Pasteurella multocida* and feeding targeted levels of chlorotetracycline following weaning prevent the formation or reduce the severity of lung lesions. However, these results do confirm that severe lung lesions reduce average daily gain in lambs. These results also suggest that larger or faster growing after weaning may be at greater risk of developing severe lung lesions.

Implications

Lung lesions negatively impact sheep production by reducing average daily gain of lambs. Development of effective intervention strategies to reduce the prevalence or severity of lung lesions would allow for increased average daily gain of lambs.

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