Effects of graded levels of zeranol implants on feedlot performance, carcass characteristics, and incidence of prolapse and mortality in lambs[1]

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The objective of this research was to determine the feasibility of implanting feedlot lambs with increasing amounts of zeranol. Previous research demonstrated increased growth performance in lambs implanted with zeranol, but also indicated a risk for increased incidence of prolapse resulting in increased mortality. If lamb feedlot operations could increase average daily gain and decrease days on feed, considerable increases in profitability could be obtained.

SUMMARY

The objective of this research was to compare the growth performance and carcass characteristics of feedlot lambs implanted with four levels of zeranol. One hundred forty four crossbred lambs (65 ± 10 lbs) were placed into sixteen feedlot pens and finished according to treatment in a 116 day finishing study. Treatments included: 1) **0** (no implant), 2) **12** (12 mg zeranol implant), 3) **24** (24 mg zeranol implant), and 4) **36** (36 mg zeranol implant). Lambs were implanted with zeranol (Ralgro®, Schering-Plough) according to treatment on day 0. All treatments received the same 84.7% corn and 15.3% market lamb pellet (DM basis) ration ad libitum. The feedlot study ended on d 116, and lambs were harvested day 118. Carcass data was collected 24 hr post-chill. There were no differences between treatments for body weight, ADG, DMI, and G:F ($P \geq 0.33$). Carcass characteristics also were not affected by treatment ($P \geq 0.07$). However, 24 and 36 treatment groups had increased incidence of prolapse ($P = 0.03$) compared to lambs implanted with 0 and 12 mg. Lambs from treatment groups 24 and 36 also had increased percent mortality ($P = 0.04$) compared to 0 lambs, with 12 being intermediate. No differences ($P \geq 0.07$) between treatments for growth and carcass characteristics were observed. The increased cost and labor associated with implanting lambs and treating prolapses, as well as the monetary loss from lamb death, indicate implanting lambs with zeranol is economically impractical.

INTRODUCTION

Zeranol has been shown to improve growth performance in lambs when implanted with 12 mg once (Field et al., 1993; Salisbury et al., 2007; and Stultz et al., 2001) or more than once (Hufstedler et al., 1996 and Nold et al., 1992). Most research indicates zeranol does not alter carcass characteristics (Arnsperger et al., 1976; Hutcheson et al., 1992; Olivares and Hallford, 1990; and Salisbury et al., 2007), although some studies report conflicting results (Field et al., 1993; Stultz et al., 2001; and Wiggins et al., 1979). Zeranol has also been

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implicated in increased incidence of prolapse (Arnsperger et al., 1976 and Salisbury et al., 2007), resulting in decreased use of zeranol in the United States. However, it has been estimated that as many as half of market lambs fed in Mexico are implanted with zeranol (G. Amaya, 2010). Research by Eckerman et al. (2010) compared lambs raised conventionally and implanted with 36 mg zeranol to lambs managed using naturally raised guidelines. Results showed conventional lambs had increased growth performance, but also had increased incidence of prolapse and mortality.

Our objective for this study was to determine the effects of graded amounts of zeranol on lamb feedlot performance and carcass characteristics, as well as incidence of prolapse and mortality. The hypothesis tested was lambs implanted with greater amounts of zeranol would have improved growth performance, without altering carcass quality or increasing incidence of prolapse or mortality.

PROCEDURES

Animal Management and Treatments. All experimental protocols were approved by the North Dakota State University Animal Care and Use Committee. At two weeks of age, tails were docked, males castrated, and all lambs were vaccinated for clostridium perfringens types C and D, as well as for tetanus (Bar Vac CD-T, Boehringer Ingelhein, Ridgefield, CT). Lambs were vaccinated with CD-T again at 60 d of age and d -1 of the study. One hundred forty four spring-born crossbred lambs (wethers and ewes, 65 ± 10 lbs) were stratified by weight and sex. Within stratification, lambs were assigned randomly to treatment: 0, 12, 24, or 36 mg zeranol implant. Treatments were applied in a completely randomized design to evaluate the outlined objectives.

Lambs were implanted according to treatment on d 0 with Ralgro® (Schering-Plough Animal Health Corp., Union, NJ). Lambs were then moved to 16 feedlot pens (n = 4). Each pen represented one experimental unit and contained 9 lambs. Lambs were offered feed ad-libitum via bulk feeders and had continuous access to clean, fresh water. Lambs had access to shade and were observed daily to monitor health. All lambs received the same ration: 84.7% corn and 15.3% market lamb pellet (DM basis, Table 1). Lambs were treated with antibiotics as necessary. Lambs which rectally or vaginally prolapsed were treated using techniques best-suited for each situation, including the use of sutures, oxytetracycline, and general antibiotics.

Experimental Periods and Sampling Procedures. The study was divided into four periods, consisting of 28, 28, 26, and 34 d, respectively. Lambs were weighed two consecutive days at initiation (d -1 and 0) of the trial and after the third and fourth period. Single day weights were taken on d 28 and 56, with two day weights taken d 81 and 82 as well as d 115 and 116. Thirty lambs minimum 140 lbs) were harvested on d 84 at Iowa Lamb Corporation in Hawarden, IA. Ninety six lambs (minimum 125 lbs) were harvested on d 118 at Iowa Lamb Corporation. Carcass data were collected 24 h post chill by trained university personnel.

Bulk feeders were emptied at the end of each period, with weight and samples of refusals collected to determine period DMI. Ration and feed ingredient samples approximately 0.44 lb) were collected every 28 d, dried at 55°C for 48 h to determine DM, and analyzed for ADF, NDF, N, and OM at the North Dakota State University Animal Science Nutrition Laboratory.

Statistics. Lamb performance data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) with pen serving as experimental unit. Carcass data were analyzed with missing data points from underweight lambs not included in the data set, with pen serving as experimental unit. Repeated measures was used to analyze period effects for BW, ADG, G:F, and DMI. The model included treatment, day, and day x treatment interaction. The covariance structure used was First Order Antedependence. Other structures were tested but First Order Ante-dependence was the best fit. Data are presented as least squares means with differences considered significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

No differences were observed between treatments for body weight gain or ADG (Table 2, $P \geq 0.64$). Feed intake and feed efficiency were not different between treatments ($P \geq 0.33$). This is similar to some of the previous research that found no effect of zeranol implant on ADG (Field et al., 1993; Nold et al., 1992; and Wiggins et al., 1976) or feed efficiency (Wiggins et al., 1976). However, the majority of the research indicates implanting feedlot lambs with 12 mg zeranol increases ADG (Arnsperger et al., 1976; Hutcheson et al., 1992; Salisbury et al., 2007; Stultz et al., 2001; Wiggins et al., 1979; and Wilson et al., 1972) and feed efficiency (Field et al., 1993; Olivares and Hallford, 1992; and Stultz et al., 2001). Previous research also indicates feed efficiency can be improved by implanting lambs twice with 12 mg zeranol (Nold et al., 1992) and both feed efficiency and ADG can be improved by implanting lambs with 12 mg of zeranol three or more times (Hufstedler et al., 1996). However, Hufstedler et al. (1996) also observed decreased dressing percentage and increased carcass maturity in lambs repeatedly implanted.

There were no differences ($P \geq 0.07$) in carcass characteristics in lambs implanted with graded levels of zeranol. This is in accordance with most research, although some studies have indicated zeranol can alter carcass characteristics. Stultz et al. (2001) observed increased carcass weights in lambs implanted with 12 mg of zeranol compared to control lambs, most likely resulting from increased live weights at the termination of the study. It was also observed that implanted lambs had increased ribeye area compared to nonimplanted lambs. Field et al. (1993) examined the effects of 12 mg zeranol implants in rams and wethers, and found zeranol caused increased fat depth in implanted wethers. However, no other differences in carcass characteristics were observed. Another study analyzing the effects of re-implanting lambs found lambs implanted at birth and weaning, and lambs implanted at 55 and 98 d of age, had increased leg score compared to lambs that received no implants (Nold et al., 1992). However, Wiggins et al. (1979) observed decreased dressing percentage in implanted lambs, which was a factor of increased gastrointestinal tract weight. Again, no other carcass characteristics were significantly altered by the use of 12 mg zeranol implants. The aforementioned research would suggest that while zeranol could potentially alter carcass characteristics, the effects are minimal.

The major effects observed in the present study were the increased percent prolapse ($P = 0.03$) in the 24 and 36 mg implant groups compared to the 12 mg and control group. The increased percent prolapse subsequently resulted in increased percent mortality ($P = 0.04$) in 24 and 36 treatments compared to 0 treatment lambs. This high incidence of morbidity likely caused lambs implanted with 24 and 36 mg zeranol to have decreased growth performance compared to what was expected. Lambs that were treated for prolapse often went off feed and gained little or no weight. Only two of the previously mentioned studies (Salisbury et al., 2007 and Arnsperger et al., 1976) reported complications of

Table 1. Ingredient and nutritional composition of diet fed to feedlot lambs

Item	Diets
Ingredient	DM basis
Whole Corn, %	84.7
Market Lamb Pellet[1], %	15.3
Nutrient composition	
CP, %	13.12
Ash, %	4.59
NDF, %	13.47
ADF, %	3.41

[1]Market Lamb Pellet contained: 0.22 g/kg chlortetracycline, 38% CP, 4.25% Ca, 0.6% P, 3.5% salt, 1.2 mg/kg Se, 52,920 IU/kg Vitamin A, 5,292 IU/kg Vitamin D, and 209 IU/kg Vitamin E.

Table 2. Effects of graded levels of zeranol on lamb growth performance, carcass characteristics, and health

Item	Treatment[1] 0	12	24	36	SEM[2]	*P* – value[3]
Body Weight[4], lb						
d 0	65	65	66	66	2.2	0.81
d 28	88	89	89	91	2.2	0.79
d 56	109	109	108	111	2.2	0.83
d 84	128	126	124	125	2.2	0.57
d 112	142	143	143	145.5	2.2	0.98
ADG[5], $lb \cdot d^{-1}$	0.74	0.73	0.71	0.67	0.04	0.52
Intake[6], $lb\ DM \cdot hd^{-1} \cdot d^{-1}$	3.75	3.70	3.84	3.84	0.11	0.94
G:F[7]	0.22	0.22	0.21	0.20	0.01	0.33
HCW, lb	74.9	74.1	73.6	73.2	1.28	0.81
Leg Score[8]	11.8	12.0	12.0	12.3	0.18	0.31
Conformation Score[8]	11.5	12.0	12.0	12.0	0.14	0.07
Fat Depth, in[9]	0.98	0.98	1.08	1.03	0.03	0.14
Body Wall Thick, in	0.29	0.30	0.33	0.30	0.02	0.62
Ribeye Area, in^2	2.75	2.68	2.53	2.55	0.08	0.17
Flank Streaking[10]	378.75	355.75	376.25	352.00	10.94	0.25
Quality Grade[8]	12.3	12.0	12.0	12.0	0.1	0.43
Yield Grade[11]	3.25	3.38	3.70	3.40	0.24	0.62
BCTRC, %[12]	45.58	45.43	44.70	45.05	0.36	0.35
Dress, %	50.73	50.73	50.83	50.25	0.40	0.74
Prolapse, %	2.78[a]	5.55[a]	24.98[b]	27.75[b]	6.31	0.03
Mortality, %	0.00[a]	5.55[ab]	11.10[b]	13.88[b]	3.10	0.04

[1]Treatments: 0 (0 mg zeranol implant), 12 (12 mg zeranol implant), 24(24 mg zeranol implant), 36 (36 mg zeranol implant).

[2]Standard Error of Mean; n = 4.

[3]*P* – value for F-tests of mean.

[4]*P*-values for body weight TRT ($P = 0.90$), Pd ($P < 0.001$) TRT x Pd ($P = 0.49$).

[5]*P*-values for ADG TRT ($P = 0.52$), Pd ($P < 0.001$) TRT x Pd ($P = 0.61$).

[6]*P*-values for Intake TRT ($P = 0.94$), Pd ($P < 0.001$) TRT x Pd ($P = 0.71$).

[7]*P*-values for G:F TRT ($P = 0.33$), Pd ($P < 0.001$) TRT x Pd ($P = 0.24$).

[8]Leg score, conformation score, and quality grade: 1 = cull to 15 = high prime.

[9]Adjusted fat depth and yield grades.

[10]Flank streaking: 100-199 = practically devoid; 200-299 = traces; 300-399 = slight; 400-499 = small; 500-599 = modest.

[11]Yield Grade = 0.4 + (10 x adjusted fat depth, in).

[12]Boneless closely trimmed retail cuts, % = (49.936 – (0.0848 x Hot Carcass Weight, lb.) - (4.376 x Fat Depth, in.) – (3.53 x BW, in.) + (2.456 x Ribeye Area, in^2)).

prolapse resulting from zeranol implants. Even the studies examining the use of 2, 3, or more implants did not report any incidences. Annotative information suggests as much as 50% of Mexican feeder lambs are implanted with zeranol (G. Amaya, 2010), but feedlot operations do not experience the rate of prolapse that was observed in the present study. However, research by Arnsperger et al. (1976) resulted in increased incidence of rectal and vaginal prolapses in lambs raised on feedlot rations. The high incidence of prolapse in the study by Arnsperger et al. (1976) did not appear to hinder the growth performance of the lambs, as we believe the case to be in the present study. Despite the prolapses, implanted lambs in studies by Arnsperger et al. (1976) still had increased ADG compared to nonimplanted lambs. Another study observed 5 and 20% percent vaginal prolapse in lambs implanted once and twice, respectively, with control lambs having no prolapses (non-significant, Salisbury et al., 2007). However, in that study implanted lambs still had increased ADG and feed efficiency compared to control lambs.

The rations of the studies by Arnsperger et al., (1976) and Salisbury et al. (2007), as well as the present study, utilized high concentrate feedlot rations. In contrast, many Mexican feedlots use lower concentrate rations (G. Amaya, 2010), which could be the cause of the decreased incidence of prolapse. Arnsperger et al. (1976) noted that lambs implanted with zeranol and raised on pasture did not experience the high rate of prolapse observed in the feedlot lambs. Salisbury et al. (2007) hypothesized that the combination of zeranol causing uterine muscle contraction and grain finishing causing increased fat deposition around the tail led to the increased incidence of vaginal prolapse. As such, high concentrate diets could be implicated in contributing to increased incidence of prolapse.

IMPLICATIONS

The increased incidence of prolapse and mortality observed in lambs implanted with 24 or 36 mg of zeranol, without increased growth performance or carcass characteristics, indicate the use of high doses of zeranol implants are not practical on conventional lamb feedlot settings that utilize high concentrate rations. The increased labor associated with implanting lambs and treating prolapses, in addition to the cost of implants and death loss, prevent the use of zeranol implants from being economically feasible in lamb feedlot operations. However, there is the possibility that zeranol could be beneficial to producers raising lambs on pasture or range. Zeranol could provide improved growth performance to lambs that would otherwise underperform on lower quality forage. This aspect of zeranol use should be further examined, but the use of zeranol implants in feedlot lambs is not recommended.

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