THE EFFECTS OF DOCK LENGTH ON THE INCIDENCE OF RECTAL PROLAPSE IN LAMBS

by

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ABSTRACT

A study was conducted at the Texas Tech University Sheep Center during the spring of 2004 and 2005. The purpose of the study was to investigate the effects of tail docking length, as well as other major contributing factors, on the incidence of rectal prolapses in lambs. The study was prompted because of the controversy associated with rules and regulations concerning dock length at local, county, state, and national livestock shows. There was a total of 382 (212 in 2004 and 170 in 2005) lambs in the study all of which were conceived and born at the Texas Tech University Sheep Center. Lambs received one of three docking treatments: 1) short-tail was removed as close to the body as possible; 2) medium-tail was removed at a location midway between the attachment of the tail to the body and the attachment of the caudal folds to the tail; and 3) long-tail was removed at the attachment of the caudal folds to the tail. An effort was made to evenly distribute treatments among breeds, gender, and birth types. The lambs were fed a high-concentrate diet in a feedlot environment. The overall incidence of rectal prolapse was 2.1%. Statistical significance was not observed among the three docking treatments; however twice as many lambs with a medium docking treatment experienced a rectal prolapse compared to long- or short-docked lambs. Female lambs had a greater ($P < 0.05$) incidence of rectal prolapse than male lambs. Additionally, the hair sheep in the study experienced 87% of the rectal prolapses observed. Sire differences were evaluated, and one sire was responsible for 62.5% of the prolapses in the study. The high percentage of hair sheep lambs prolapsing in the study suggests that genetics may be a contributing factor to predisposing lambs to rectal prolapse. Although the results of the study did not

find statistical significance as had previous studies concerning dock length and the incidence of rectal prolapse, it does not eliminate dock length as a potential contributing factor to rectal prolapse in lambs. The results of this study suggest that there are equal to or more significant than tail dock length that rectal prolapse in lambs. More research needs to be conducted with reference to the given issue before additional rules and regulations are implemented at livestock shows.

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CHAPTER I

LITERATURE REVIEW

Introduction

There has been a great deal of controversy surrounding the sheep industry in recent years. The cause of this controversy is the issue of how the dock length of a lamb's tail affects its chances of having a rectal prolapse. A rectal prolapse occurs when the rectum of an animal protrudes past the anus outside of the body cavity. If the prolapse remains outside the body, the soft tissue is susceptible to tearing, leading to blood loss as well as constipation and infection. The negative effects associated with a rectal prolapse can result in loss of performance and even death. Thus prolapses can be detrimental to both the animal and to the profits of sheep producers.

Reasons to Dock

Docking lambs is a practice that removes the tail from the animal. The purpose of docking is to decrease the chances of fly strike (Cutaneous myiasis). Fly strike occurs when the lamb's tail is long and it collects fecal matter and dirt that creates a desirable environment for flies to lay eggs. These eggs hatch and become larvae. The fly larvae feed on the infected skin on and around the tail. If animals with the larvae are not treated, they may die from shock, intoxication, or infection (Merck, 1998). This problem has been common knowledge among producers for years, which led to studies that found that lambs that were docked were less likely to suffer from fly strike (French et al., 1994; Webb-Ware et al., 2000). In addition to fly strike, another negative aspect of long tail is

that they are not as valuable when sold in normal market because of the inedible weight (Battaglia, 1998). Battaglia (1998) also found that the docking ewes increased production because the tail did not interfere with breeding and lambing. Most producers remove the tail when the animals are still young to decrease stress and enhance the marketability of their product.

In contrast, others believe that the complete removal of the tail can cause negative effects to the lamb. Windels (1990) conducted a study that found that one of the main contributing factors to the cause of rectal prolapses was shorter dock length. This study was the basis for a large-scale study that was headquartered at the University of Wisconsin-Madison under Dr. Thomas. Thomas et al., (2003) conducted a study that investigated the length of docked tail in relation to the incidence of rectal prolapse in lambs. This study found that short docked lambs had a greater chance of prolapsing than medium or long docked lambs (Thomas et al., 2003). Other researchers found that the complete removal of the tail actually increased the incidence fly strike compared with lambs that were docked but had some tail remaining (Watts and Marchant, 1977; Watts and Luff, 1978). In addition, some sheep production manuals recommend that it is desirable to leave some tail (2.5 to 7.6cm) on the lamb, with the belief that the tail would decrease the risk of a rectal prolapse. (e.g., Williams, 1990: ASI, 1996; Battaglia, 1998). Collectively, the studies that evaluated dock length complicates what the ideal dock length is, prompting the need for further research.

Docking Methods

Over the years, the sheep industry has used several different methods of tail removal. Some have been popular for a time and then get replaced by new methods. There are six major methods for docking lambs, consisting of a sharp pocketknife, emasculator, emasculatome, elastrator, hot docking iron and all-in-one pliers (Battaglia, 1998). The sharp pocketknife method is still popular today. The lamb is placed in a position where the tail is against a solid surface. The caudle folds are then found under the tail and the tail is severed between the vertebra, leaving approximately 2.5 cm of tail on the body (Battaglia, 1998). The emasculator was originally used for castrating bulls and stallions; however, it can be utilized in sheep production. The emasculator is an instrument that has a cutting edge and a crushing surface. The emasculator is placed on the tail, with the crushing surface toward the lamb. When the handles of the emasculator are compressed the instrument crushes blood vessels as it cuts the tail (Battaglia, 1998). The emasculatome is an instrument that has two blunt edges that pinch the tail. After the tail is pinched at one inch from the body, a pocketknife is used to cut the remaining tail. This method decreases bleeding because the blood vessels are pinched by the blunt edges. The hot docking iron method is used in situations where lambs cannot be checked often. To begin the docking irons are heated to red-hot condition. The hot irons are placed at the desired length of tail and it is compressed down cutting the tail while burning. This method is bloodless as it cauterizes the veins and the heat disinfects as it cuts (Battaglia, 1998). The hot docking method is fast and low maintenance to the animal after the tail is removed; however, this method requires more equipment than the other methods.

The all-in-one pliers docking method is both fast and inexpensive. Pruning shears can also be used for completing this task. The lamb is placed in a similar position as the pocketknife method. The shears or all-in-one pliers are placed at the desired length, and the handles are compressed removing the tail from the body. Lambs that have been docked by this method have to be observed for excessive bleeding.

The Elastrator method is the method of docking that the aforementioned studies utilized (Thomas et al., 2003); (Windels, 1990). The elastrator has four prongs that hold the Elastrator ring or band. The handles of the elastrator are compressed, stretching the ring enough to place it over the tail. When the desired length is found, the handles are released leaving the band on the tail. The tightly fitting band cuts off the blood flow to the tail, and the tail should fall off in one to two weeks, this method of docking puts the lamb at risk for tetanus disease, so the producer will give the lamb a tetanus vaccination prior to tail docking (Battaglia, 1998). The elastrator band is the method of choice for sheep producers in a show stock situation. The elastrator allows an individual to place the ring as close to the animals' body as possible. Over the years show lamb producers have progressively been docking their lambs' tails shorter. Thus, elastrator method has created a great deal of controversy because this method can be used to produce an "ultra-short docked lamb".

Tail Docking Studies

Some, like Windels (1990), felt that the ultra-short dock might be a contributing factor to rectal prolapse in lambs. It was this theory that prompted the studies by both Windels (1990) and later Thomas et al,.(2003) that investigated what role dock length

plays in relation to rectal prolapse. It was the finding of both studies that the length of the remaining tail on the lamb can significantly influence the incidence of rectal prolapse in lambs. Windels (1990) and the Thomas et al., (2003) study also found other contributing factors to rectal prolapses, such as sex, environmental conditions and body condition as well.

As a result of their studies, many states (California, Colorado [National Western Stock show], Maryland, Washington, West Virginia, and Wyoming) have implemented rules regarding a required length of dock to qualify for the livestock show. Other states like Ohio have presented the information regarding dock length and rectal prolapse to the producers and exhibitors. Ohio leaves the decisions on the dock length of their lambs up to the producers (Ohio State University Extension, 2002). As a result the absence of a consistent and effective method of measuring the length of the dock, many youth have been disqualified from livestock shows. Disqualification of a youth exhibitor causes economic loss in addition to changing the species they exhibit, or even worse, causing them to stop participating in a valuable youth agricultural program. The most notable of lamb disqualifications have been at the Wyoming State Fair. In 2003, 41 lambs were disqualified, and again in 2005 47 lambs had tails that were evaluated as too short. These situations were described in the popular press as follows: "Leaving dozens of 4-H youth in tears and producers wondering how to rectify a long standing dilemma. Pam Meyer of Saratoga raises club lambs and had children showing at the fair. From a row of 10 lambs, all docked at the same time, the same way, only half made the cut" (Delbrige, Star-Tribune, 2005). The disqualification of these animals validates the fact the producers and exhibitors still are not able to determine the proper dock length needed to compete at

livestock shows. The confusion can be attributed to the different techniques used by different livestock shows. For example, the National Western Stock Show runs a credit card up the rump to determine whether the lamb's tail will lift, whereas other shows use pencils and additional devices. Finally a lamb's tail at the event of docking may lift; however, during the feeding phase the tail can accumulate enough body condition and muscle mass to make it subject to disqualification. It is the opinion of the author of this paper that before rules are implemented more research needs to be conducted investigating dock length and its effect on the incidence of rectal prolapse.

CHPATER II

OBJECTIVES

The objective of this study was to determine whether tail length of a lamb affects the incidence of rectal prolapse in lambs. More specifically, this study evaluated factors such as breed, sex, and genotype to determine whether tail length is a major contributing factor in rectal prolapses. Results will be compared with other studies.

CHAPTER III

MATERIALS AND METHODS

Animal Source

The experimental group was born at the Texas Tech Sheep Center in New Deal, Texas in Spring 2004 (n = 212) and 2005 (n = 170). The ewes that were used in the study were Rambouillet, Suffolk x Hampshire, Crossbred, and Hair sheep. Some Rambouillet ewes that were used carried the callipyge gene. The callipyge gene, resulting from a neomutation located at ovine chromosome 18, is a genetic trait that significantly increases the muscle mass of lambs at 45 to 60 d of age.

During pregnancy, the ewes had ad libitum access to long stemmed Sudan-grass hay (Sorghum bicolor). The ewes were placed on an increased nutritional plane in the final trimester. This action was accomplished by feeding 0.91 kg of whole corn as-fed once daily. The nutritional plane was increased in an effort to compensate for the elevated nutritional demands of the fetus in the final trimester.

The ewes lambed in large indoor pens (15m x 25m) with outdoor access. The lambs were born on a dirt surface. The ewes lambed unassisted, except when a ewe was experiencing dystocia. Ewes and lambs were not placed in a lambing pen unless the ewe needed assistance taking a lamb or grafting a lamb. The ewes and lambs remained in the safety of a pen (15 m x 15 m cover area and 15 m x 10 m open) until they reached 14 d of age. In the lambing barn, the ewes had ad libitum access to Sudangrass hay (Sorghum bicolor) with 0.91 kg as-fed whole corn once daily. When the lambs reached

approximately 14 d of age, ewe/lamb pairs were moved to the larger pens (30 m x 50 m metal panel with 3 m x 9 m metal shelters). Automatic watering systems were used in the larger pens.

Before weaning, the lambs had ad libitum access to creep feed (Table 2.1), a feed that the lambs have access to via small openings in panels that prevent the ewes from being able to enter the feeding area. Creep feed is used in many flocks to acclimate growing lambs to grain-based concentrate feed, as well as increase the weaning weight of the lambs. In addition, the ewes/lamb pairs had ad libitum access to long-stemmed Sudangrass hay and sheep mineral block (Hi-Pro Feeds, Friona, TX). At approximately 3 wk of age, the ewe/lamb pairs were moved to dry land wheat pasture (Triticum itdeis L.) during the daylight hours. The wheat was in the jointing stage of growth when the ewe/lamb pairs were grazing the pasture. The ewe/lamb pairs were only exposed to the wheat forage in the day because the lambs were less likely to be killed by predators during daylight hours. The Texas Tech University Sheep Center uses donkeys as further protection against predators. While grazing the wheat pasture, the ewes and lambs had ad libitum access to forage. After weaning, the ewes were separated from the lambs and placed in the drying pens (30 m x 40 m limited shelter). The drying pen is where the lactating ewes are taken after weaning. Drying refers to restricting the ewes feed and water to prevent excess pressure in the mammary tissue. It is well documented that ewes that are maintained on the same nutritional plane as they were before weaning are more likely to experience inflammation of the mammary gland or udder, a condition known as mastitis. The drying process accelerates the removal of fluids from the ewes' udder.

Table 2.1 Creep and Finishing Diet (% of diet, DM basis)

Ingredient	Growing Diet
Cracked Corn	63.26
Cottonseed Meal 41% CP	5.75
Soybean Meal 44% CP	3.76
Cottonseed Hulls	10.50
Alfalfa Pellets	10.00
Calcium Carbonate	1.20
Ammonium Chloride	0.50
Cane Molasses	5.00
Premix[a]	0.03

[a]Premix included Vitamin A, Selenium, and Decox at levels recommended by NRC (1985)

The lambs were weaned at approximately 60 d of age or when they reached 22.7 kg of BW. At weaning, the lambs were de-wormed with Valbazen, a broad-spectrum de-wormer (Pfizer Animal Health, Exton, PA). The lambs were then moved to the feeding facility. The feeding pens are partly sheltered with outdoor access. The soil-surfaced pens are 15 m x 25 m, and constructed of metal panels. The lambs were fed in concrete fenceline feeders, 15 m x 0.46 m, which were along the width of the feeding pens. The lambs were placed on a grain-based concentrate diet (Table 1.1) and had access to an automatic watering system. Lambs were de-wormed again 60 d after weaning using Ivomec (Merial, Duluth, GA). Ivomec was used to rotate the de-wormers that the lambs were exposed to and thereby eliminate resistant parasites and parasites not labeled for elimination by Valbazen. Lambs were hand-fed the concentrate feed (amount guided by the NRC (1985), see Table 2.2, 2.3, and 2.4) once daily until they reached the target weight of 56.7 kg. Once the target weight was achieved the lambs were then removed from the study. A percentage of the ewe lambs were retained for replacement. All wether lambs were sold in various markets.

Table 2.2 Chemical Compositions of Creep and Growing Diet

	Growing Diet
DM, %	87.26
Ash, %[a]	7.53
CP, %[a]	13.82
Ca, %[a]	1.03
P, %[a]	0.39

[a] DM Basis

Table 2.3 Daily Nutrient Requirements for Finishing Lambs (30 kg).[a]

	Crude Protein		Ca	P	Vit. A Activity	Vit. E Activity
	(g)	(lb)	(g)	(g)	(IU)	(IU)
Lambs finishing 4 to 7 months old	191	0.42	6.6	3.2	1410	20

[a]Reported by NRC (1985)

Table 2.4 Nutrient Concentration in Diets for Sheep (100% DM Basis).[a]

	Crude Protein	Ca	P	Vit. A Activity	Vit. E Activity
	(%)	(%)	(%)	(IU/kg)	(IU/kg)
Lambs finishing 4 to 7 months old	14.7	0.51	0.24	1085	15

[a]Reported by NRC (1985)

Lamb Processing

The lambs were processed at 1 to 4 d of age. They received an Allflex ear tag for identification, which was administered via an Allflex Total Tagger (Allflex USA, Inc., Fort Worth, TX). Male lambs were tagged in the right ear, whereas the ewe lambs received tags in the left ear. Because of the risk of tetanus resulting from the use of the elastrator method, lambs were given Bar Vac clostridium perfringens types C and D with tetanus toxoid (Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO). At three to four

weeks of age the lambs received 2 mL of this vaccine subcutaneously in the hairless portion of the breastplate, and subsequently observed for adverse reactions to the vaccination. In the two-year study, no lambs were lost as a result of tetanus or anaphylactic shock. The lamb's identification number, type of birth (e.g., single vs. twin or triplet), dam's identification number, breed, and genotype (callipyge gene) were recorded. Approximately 21 d after initial vaccination, lambs were gathered again for their booster vaccination of Bar Vac clostridium perfringens types C and D with tetanus toxoid using the same technique as described above. Lambs also were viewed for tail infection and "fly strike." In the case of an infection, lambs were treated with fly spray and Oxy-Tet 100 (oxytetracycline; 1mL/100mg; Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO). As noted previously, lambs were weaned at 60 d of age or 22.7 kg of BW was reached. Weaned lambs were sorted according to breed and placed in feeding pens as described above.

Docking Procedure

The elastrator band was the only docking method used in the study. Every lamb in the two-year study was docked by one person. Having only one person docking lambs allowed consistency in dock length throughout the study.

Three treatment groups were established. A short-docked lamb was a lamb for which the elastrator band was placed as close as possible to the lamb's body. A medium-docked lamb was achieved by placing the elastrator band on the tail at a location midway between the attachment of the tail to the body and the attachment of the caudal folds to the tail. To create the long-docked lamb, the elastrator band was placed at the attachment

the caudal folds to the tail. The caudal folds are the webs of skin on both sides of the anus, with one end connected to the ventral side of the tail and the other end connected to the body (Thomas et al., 2003). To evaluate the importance of dock length on the incidence of rectal prolapse, three treatments were dispersed as evenly as possible within each breed, sex, genotype and type of birth.

Castration

Castration is a procedure that removes the testicles from the animal's body or eliminates their function as a reproductive organ. The lambs were castrated at approximately 30 d of age. The procedure was performed by students in a Texas Tech Animal Science Sheep and Goat Production Lab. The elastrator was used for the castration of the lambs. The scrotum area was sprayed with a fly repellent, and lambs were monitored for infection for 14 d after application of the Elastrator band. All male lambs born in the 2-yr study were castrated, and no animals died as a result of castration.

Data Collection

In this study, a rectal prolapse was defined as an inversion of the rectum that protruded 4 cm or more outside of the lamb's body and remained exterior while the animal was standing. If a lamb was observed with a rectal prolapse and in the future was not observed with a rectal prolapse, it was still classified as having a rectal prolapse (Thomas et al, 2003). Animals were evaluated for rectal prolapse every 24 h. If a lamb prolapsed and the prolapse was exteriorized for more than 24 h, the event was recorded, and the lamb was treated as described in the next section.

Prolapse Treatment

An elastrator band was placed over the exposed tissue and released. This procedure cuts off the blood flow of the exposed tissue, and within 72 h, the tissue would fall off. Ten minutes before the placing the elastrator band on the exposed tissue, 2 mL of Banamine (Flunixin Meglumine; Schering-Plough Animal Health, Union, NJ). The Banamine was used to decrease the pain and thereby decrease the stress on the lamb. Because of the exposed tissue and potential for infection, a 5-mL injection of oxytetracycline was administered intramuscularly in the neck. This antibiotic injection was repeated for 5 consecutive days. During the 2-yr study, none of the lambs treated for a rectal prolapse died as a result of the treatment.

Statistical Analyses

Data were summarized by year and across years with the Freq procedure of SAS (SAS Inst., Inc., Cary, NC). Effects of treatment on the proportion of rectal prolapses, was analyzed using the Glimmix procedure of SAS, assuming a binomial distribution (prolapse vs. no prolapse). Initial analyses fitted models with effects of dam nested within breed, sire nested within breed, breed, sex, type of birth, callipyge genotype, year, and treatment. Nested dam and sire effects were not significant, and subsequent models were reduced to the fixed effect of breed. Year was treated as a fixed effect because models would not converge when it was considered a random effect. Interactions among breed, sex, type of birth, and callipyge genotype were not evaluated, but interactions of breed, sex, type of birth, and callipyge genotype with treatment were not significant ($P >$

0.10). After removal of type of birth and callipyge genotype ($P > 0.10$), the final model included the fixed effects of breed, sex, treatment, and year.

CHAPTER IV

RESULTS AND DISCUSSION

Gender

A total of 382 lambs was used in this study. Of this total, 174 were ewe lambs, and 208 castrated male lambs (wethers). In the two-year study, only eight lambs were observed to have a rectal prolapse. Six of the prolapses lambs occurred in ewe lambs, and two wether lambs suffered prolapse.

Breed

The breeds that were represented in this study included the Hair Sheep, Rambouillet, Suffolk x Hampshire and Crossbred (various combinations of Rambouillet, Suffolk, Hampshire, and Hair Sheep). There were 131 Rambouillet, 63 Suffolk x Hampshire, 58 Crossbreed and 130 Hair sheep used. Of the lambs that prolapsed in the study, seven were Hair Sheep and one was a Rambouillet. No prolapse was seen in either the Suffolk x Hampshire or Crossbred animals.

Dam

The Dams were evaluated to test the genetic component in relation to rectal prolapse in lambs. No ewes that had multiple births had offspring that experienced a rectal prolapse. Therefore the maternal contribution to rectal prolapse could not be examined.

Sire

There were six sires that were used in the two-year study. The sires were evaluated for the number of lambs that they sired that experienced a rectal prolapse. One ram's (Hair) progeny accounted for five prolapsed lambs (62.5%), one Barbado ram accounted for two lambs (25%) and the Homozygous Rambouillet ram accounted for one prolapsed lamb (12.5%).

Year

The study was conducted over a 2-year period (2004 and 2005). In 2004, there were six lambs that experienced rectal prolapses, whereas in 2005, two lambs prolapsed.

Type of Birth

Type of birth was evaluated to determine whether full siblings would both prolapse with contrasting docking treatments. There were not any full siblings that experienced rectal prolapses, which prevented any further evaluation.

Genotype

The callipyge gene was represented in all breed categories. There were 125 lambs that either carried or expressed the callipyge gene. The callipyge genotype was determined by the physical expression of the gene. If the animals did not express the callipyge gene, the genotype could be determined by examining parentage allele tests. There was only one of these lambs with the callipyge genotype that prolapsed over the course of the two-year study.

Dock length

The 382 lambs were docked using the short, medium, or long docking treatments described in Chapter II. There were 139 short-, 124 medium-, and 119 long-docked lambs respectively, in each of the three treatment groups. Of the eight lambs that experienced a rectal prolapse, one was from the short-docked treatment, six were from the medium-docked treatment, and one from the long-docked treatment. All of the relevant data is presented in Table 4.1.

Table 4.1 Evaluation of the incidence of rectal prolapse in lambs with the short, medium and long docking treatments

				No. of Lambs/ Treatment[a]				No. of Rectal Prolapses		
Location	Breed	Sex[d]	Environment[c]	S	M	L		S	M	L
[b]Texas Tech	Hair	M	Feedlot	23	22	18		0	1	0
Texas Tech	Hair	F	Feedlot	23	22	22		1	5	0
Texas Tech	Finewool	M	Feedlot	29	24	21		0	0	1
Texas Tech	Finewool	F	Feedlot	20	21	16		0	0	0
Texas Tech	Cross[e]	M	Feedlot	15	10	8		0	0	0
Texas Tech	Cross	F	Feedlot	9	9	7		0	0	0
Texas Tech	Blackface	M	Feedlot	15	8	15		0	0	0
Texas Tech	Blaceface	F	Feedlot	6	7	12		0	0	0
Total within docking treatments				139	124	119		1	6	1

Total Sex 174 Females 208 Males for 54% Males and 46% Females

[a]Treatment: S = Short, M = Medium, L = Long
[b]Texas Tech: Texas Tech University Sheep Center, New Deal, TX
[c]Environment is in reference to the facility and fee type intake is in reference to the highly concentrated feed diet and confinement situation
[d]Sex: M = Male, F = Female
[e]Cross is a combination of two or more of the above breeds
[f]Blackface is a combination of the Suffolk and Hampshire Breeds

Discussion

Sheep producers have long known that female lambs are more likely to experience a rectal prolapse than male lambs. Research by Thomas et al. (2003) agree with this point, as their research found that likelihood of a rectal prolapse was 1.9 times greater for ewe lambs than for male lambs. Similarly, Windell (1990) noted that ewe lambs had an incidence 2.3 times greater than males. The reason for this could possibly be the anatomy of a females' body, which is designed for parturition. In this process, bones and muscles in and around the reproductive tract need the flexibility for a neonate to be born. It may be possible that the muscles surrounding the rectum that are responsible for retaining it within the body are not as constricting in ewe lambs as in the male. Therefore, a ewe lamb that is experiencing adverse environmental conditions that cause pneumonia and chronic coughing can stimulate a rectal prolapse. Mamadou Niang referred to the given situation as "coughing syndrome because of the nature of its clinical signs which include primary paroxysmal coughing predisposing to rectal prolapse and reduced weight gain" (Niang, et. al. 1998).

The present study also evaluated the differences of the incidence of rectal prolapse among different breeds. The Hair Sheep lambs had a greater ($P < 0.05$) incidence of rectal prolapse than other breeds in the study. One possible explanation for the greater incidence of rectal prolapse could be that the hair sheep were well represented (130) in experimental units; however, the Rambouillet breed had the greatest representation (131) and only had one lamb prolapse. These data suggests that this particular flock of hair sheep may have a greater genetic propensity for rectal prolapsing.

Another possibility for the Hair Sheep's high percentage of rectal prolapses can be attributed to genetic selection. The hair breeds of sheep have a naturally short tail. Because of this, they are not at risk to fly strike and producers have not subjected the hair breeds to tail docking. If the length of the docked tail is a factor contributing to rectal prolapse in lambs, then it is possible that producers have not genetically selected against rectal prolapse, in the hair breeds of sheep. Therefore, when the Hair Sheep lambs in the present study were docked, it exposed genetic weaknesses with regard to rectal prolapse. The results are surprising considering that is well documented that blackface breeds are generally more likely to experience a rectal prolapse compared to other breeds. This observation further validates the integrity of genetics as a major contributing factor to rectal prolapses in lambs. Each breed was not equally represented in experimental units; however, a relative balance of treatment was maintained throughout each breed. Within each breed, all treatments were applied evenly between male and female lambs. Another possibility for the differences in the results concerning breeds can be attributed to the use of different genetic pools. For example, the blackface flock in this study may not have been as genetically predisposed to rectal prolapse as those in the Thomas et al. (2003) study. This study had a lower (2.2%) overall incidence of rectal prolapse than the Thomas et al. (2003) study (4.90%).

The dam numbers were included in the data configuration to evaluate the maternal influence on the incidence of rectal prolapse in lambs. The data were analyzed to determine whether a single dam experienced a multiple birth had two or more of her offspring rectally prolapse. The significance to the study would be that full siblings with contrasting docking treatments prolapsed; however, the data did not yield any full

siblings that prolapsed. The absence of full sibling prolapses does not disprove the genetic predisposition to rectal prolapses, but the data do not suggest a maternal influence on rectal prolapse in their offspring.

There is a great deal of interest in the sire's role in predisposing their offspring to rectal prolapsing. This interest arose from many sheep producers indicating that certain sires had a higher percentage of progeny that rectally prolapsed than others. The experiment was designed to use single sire mating to maintain which sire bred each dam. Thus, the experiment allowed for the paternal identity of each lamb included in the study to be known. There were six sires representing five breeds. Three sires accounted for all the prolapsed lambs. The Hair sheep sire was responsible for siring 62.5% of prolapsed lambs, whereas the other two sires collectively accounted for 37.5% respectively (see Table 4.2). Because of the relatively low numbers of lambs that experienced a rectal prolapse in the study, the sire influence failed to achieve significance. Nonetheless, it would be irresponsible to ignore the trend that developed connecting the Hair Sheep ram and a relatively high percentage of rectal prolapse in progeny. As noted before, this observation also indicates a relationship to the genetic predisposition to rectal prolapse.

Table 4.2 Sire Evaluations

Sire	Breed	No. of Lambs Sired	No. of Rectal Prolapse
1019	Hampshire	36	0
176	Suffolk	78	0
2008	Rambouillet	80	0
Barbado	Barbado	49	2
Hair	St. Croix	86	5
Homozygous	Rambouillet	52	1

The number of prolapses per year was evaluated. In 2004, six lambs prolapsed whereas 2005 yielded 2 rectal prolapse. The data are surprising as relatively the same ewes were mated to the same sires as the previous year. Windels (1990) also observed a significant year difference as 1988 yielded 2 prolapsed lambs, whereas 1989 yielded 21 rectal prolapses. The dramatic difference in prolapses may be attributed to environmental factors such as rainfall, heat, and humidity.

The experiment was designed to record the birth type of each experimental unit. This information allowed for the evaluation of full siblings and to investigation of trends in rectal prolapse. The experiment did not yield any full siblings that prolapsed, in effect halting any further evaluation in birth type and its relationship, if any, to rectal prolapse in lambs.

Although it is not documented, some people believe that the callipyge gene may be associated with a greater incidence of rectal prolapses in lambs. This is the first known study that has evaluated relationship between the callipyge gene and rectal prolapse in lambs. Of the 125 lambs in the study that either expressed or carried this gene, only one experienced a rectal prolapse. It is possible that the genetic pool of the callipyge lambs has a low incidence of rectal prolapse; however, these particular data suggest that the callipyge gene does not increase the incidence of rectal prolapse.

There was no significant difference among the three dock length treatments. There was a 0.27% incidence with the short dock, 1.6% with the medium dock, and 0.27% with the long dock, with no statistically significant differences among the three groups. The current findings do not agree with those of the Thomas et al. (2003) study, who found that incidence of rectal prolapse was greater ($P < 0.05$) for short-docked lambs (7.81%) than for either medium (3.97%) or long-docked (1.85%) lambs. Windels (1990) also reported a lower ($P < 0.05$) incidence of rectal prolapse in lambs with a longer dock length.

Compared with the study performed by Thomas et al. (2003), the differences with the present study could be attributable to the variation involved with their experimental design compared with the one used in the present study. The present study balanced the treatment groups and exposed all the groups to the short, medium, and long docking treatments. This study is unique in this regard, as all previous studies relative to rectal prolapse, in an effort to increase the experimental units, were forced to change the docking protocol at different research facilities. One example of this point would be that in the Thomas et al. (2003) study, Iowa State University used the long and short

treatments, whereas the Ohio State University used the short and medium treatments. The variation of facilities used in the Thomas study could have created variables that affected the data such as different diets, air quality, and temperature. Moreover, in the present study, one technician performed the docking treatments of every experimental unit. The use of many individuals, as in the Thomas et al (2003) study, applying the elastrator band could account for the discrepancies in their data. Given the subjective nature of the docking protocol, it would likely be advantageous to use one individual for consistency, as was done in the present experiment.

Environmental factors may play a significant role in contributing to the incidence of rectal prolapse. Environmental factors such as feed type (concentrate vs. forage), air quality, and body condition may have an effect on the incidence of rectal prolapse. Air quality refers to the cleanliness of the air that the animals are breathing. The environment lambs were exposed to in this study at the Texas Tech University Sheep Center was a feedlot environment, which means that the air sometimes was contaminated with dust and fecal matter. Over time, inhaling this caused less than 5% of the lambs to develop a chronic cough (persistent non-productive, hacking cough), putting stress on the rectum. The coughing by the lambs was identified as a significant contributing factor to rectal prolapse because all lambs that prolapsed were observed coughing before the event. It is important to note, however, that some lambs with the chronic cough did not experience a rectal prolapse. The preceding observation could possibly be explained by the genetic predisposition to rectal prolapse discussed earlier in the chapter.

The lambs used in the study were relatively healthy throughout the study. As mentioned above, there was a chronic cough, was noted in a low percentage of the lambs

in 2004 and 2005. There was a 0% death loss on lambs treated for prolapse. The main cause of death was pneumonia and starvation, of which typically occurred in the first 14 d after birth. Of the 139 lambs that received the short –docking treatment 0 cases of fly strike were noticed. This observation does not concur with others who stated that complete removal of the tail can increase the incidence of fly strike (Watts and Marchant,1977; Watts and Luff, 1978). Two long-docked lambs were treated for fly strike in 2005. In these cases the lambs scoured, and the feces collected around the long dock providing the opportunity for flies to lay eggs in the soiled wool.

CHAPTER V

SUMMARY

This study was conducted to evaluate the possible causes for rectal prolapse in lambs. Noting the limitations of earlier experiments, the experimental design was to eliminate as many variables as possible given the experimental facility and equipment used. One particular factor of interest with respect to rectal prolapses is tail-docking length, so this factor was varied as an experimental treatment. A short-docked lamb was a lamb for which the elastrator band was placed as close as possible to the lamb's body. A medium-docked lamb was achieved by placing the elastrator band on the tail at a location midway between the attachment of the tail to the body and the attachment of the caudal folds to the tail. To create the long-docked lamb, the elastrator band was placed at the attachment the caudal folds to the tail.

A single individual was responsible for the application of the elastrator band at the desired location on the lamb's tail. Because the location for placement of the elastrator band is subjective, using one person to perform tail docking should decrease human error. Docking treatments were balanced across breeds, sex, type of birth, and callipyge genotype. For example, the experiment was designed to have approximately the same number of Rambouillet, short-docked ewe lambs as Rambouillet, short-docked wether lambs. Furthermore, if lambs were born twins or triplets, an effort was made to give each lamb contrasting treatments. The contrasting treatments enhanced the ability of the experimental approach to evaluate genetics as a factor contributing to rectal prolapses

in lambs. Unfortunately, as a result death loss of experimental units, the ideal balance of type of birth, treatment, and sex was not completely achieved. The experiment also was designed to eliminate the lambs' diet as a variable. All lambs in the study were placed on the same creep feed, forage, and finishing diet, which should have decreased the variability associated with different diets.

All lambs that were used in the study were conceived, born and raised in the same environment. Having all the animals at one facility allowed us to eliminate the variability associated with a multi-facility study. Further, lambs were vaccinated with the same vaccine and de-wormed with the same types of de-wormer. The pens the lambs were raised in were dusty at times, which was thought to be a cause of coughing by some lambs. Overall, these methods aided in eliminating variability that was observed in previous studies concerning rectal prolapse in lambs.

Results of this study indicated that there were no statistically significant differences among the three tail docking treatments. However, significance was noted with respect to breed differences as hair sheep had a greater ($P < 0.05$) incidence of rectal prolapse than other breeds. This finding coupled with the unmistakable trend found for one Hair sheep sire that generated 62.5% of the rectal prolapses in the study, implicates genetics as a major contributing factor of rectal prolapses in lambs. Environment in the form of a chronic cough seemed to affect rectal prolapse as lambs placed more pressure on the rectum in the act of coughing. Although there are an abundance of theories regarding excessive body condition, environment, genetics, nerve damage at docking, and diets, however, there is a limited or no documentation of their role in relation to rectal prolapsing in lambs. The results of this study do not eliminate dock length as a

contributing factor to rectal prolapse, but rather offer other factors that are equally or more significant.

Reasonable people can agree that additional research would be advantageous for all involved. Thomas et al., (2003) were correct in asserting the importance of animal welfare, so it follows that as educators, we should be equally concerned with other "animals"; the youth livestock exhibitor. More research needs to be conducted, as this study and other studies concerning dock length and the incidence of rectal prolapse offer more questions than answers. Researchers should investigate these questions before more youth exhibitors agricultural experience ends with disqualification from inconsistent and subjective rules and regulations.

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