BULLER STEERS - CAUSES AND CONTROL

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ABSTRACT

Male and female sexual behavior are regulated by the effect of estradiol on the brain. The effects of steroid hormones on the development of sexual behavior of cattle have not been determined. Steers that are bullers appear to have a physiological defect. Because steroid hormones influence the brain to regulate sexual behavior, treatment of bullers with specific hormones may reduce buller activity.

INTRODUCTION

The occurrence of buller steers is an abnormal social condition that greatly reduces productivity. A buller steer is repeatedly mounted and ridden by its penmates. This abnormal activity reduces weight gain, and may cause injury and even death. Many factors are associated with bullers such as management, stress, climatic environment and implanting with anabolic hormones. Buller steers cannot be produced experimentally to conduct controlled research, so most information on the syndrome has been obtained from animals in a feed yard when the incidence of bullers is greater than expected normally. Thus, the cause of buller steers has not been clearly established.

Factors related to an increased incidence of bullers

Social factors may be a stimulus that increases the incidence of bullers. The use of large pens with many steers and mixing groups of steers when they enter the feedlot may increase the incidence of bulling. Sexual behavior of animal is induced by sex steroid hormones such as estradiol and androgens. These are the same hormones or the analogues that are contained in growth implants. Various implants have been suggested as a possible cause of bullers. Irwin and coworkers (1979) found that the incidence of bullers differed with the type of implant. Only about .5% of steers implanted with Ralgro were bullers; this compares with 1.4% for steers implanted with diethylstilbesterol (DES) and 2.5% for steers implanted with progesterone and estradiol. The incidence of bullers was greater when steers were implanted initially with DES followed by an implant containing progesterone and estradiol benzoate (Synovex-S), than when steers were implanted and reimplanted with DES (Schake et al., 1979). Caution must be used when interpreting these experiments because large numbers of cattle were studied over an extended time period so that all variables were not controlled. In addition, because the incidence of bullers usually is 1 to 4%, bullers may have a physiological defect that is exacerbated by management. If an implant, feed additive, environmental condition, or other factor causes bullers, we would expect to see a much greater percentage of the steers exhibiting the condition.

Environmental Estrogens

Hormones influence the function of cells by binding to specific receptors. Steroid hormones, such as estradiol and testosterone, bind to receptors in the nucleus of cells and cause transcription of DNA. This ultimately results in the synthesis of specific proteins that can alter the function of cells. Receptors for steroid hormones are present in many types of cells located in the reproductive tract, muscle, brain and other tissues. Hormones produced by an animal's endocrine glands control normal growth and function of tissues and can regulate reproductive behavior.

Estrogens are produced by the ovary, placenta and adrenal gland of most females and by the testis and adrenal of males. Additionally, some plants and molds produce compounds that have estrogenic activity. For instance zeranol, produced by a mold that grows on grain, is an estrogen and is the active ingredient in one commercially available product. Other compounds synthesized by chemists may bind to estradiol receptors in cells and thus have estrogenic effects. Diethylstilbesterol (DES), although not a steroid, is a very potent estrogen that was used as a growth enhancing implant prior to 1979.

One environmental estrogen that can influence animals is the pesticide DDT. Although banned in the U.S. since the early 1970s, DDT is still present in the environment and causes feminization of wildlife. The presence of DDT in the environment in Florida has been linked to the production of male alligators with smaller than normal penises (McLachlan and Arnold, 1996). This response is associated with the estrogenic effect of DDT that inhibits normal development of the male reproductive system. Thus compounds that have been synthesized and are found in the environment may have effects on animals similar to the hormones normally produced by animals.

Development of Sexual Behavior

During prenatal development of mammals, absence of testicular secretions results in the development of the female reproductive tract and feminine sexual behavior. The genetic sex of an animal dictates if testicular secretions will occur; this results in physiological changes that are irreversible. At or near the time of puberty, gonadal steroid hormones stimulate the onset of male sexual behavior. If the testicular hormones are removed, such as by castration, the animals cease to exhibit male sexual behavior.

The brain of mammals becomes masculinized or defeminized by the presence of androgens. In pigs, mating behavior is influenced by exposure to testosterone during pubertal development (Ford, 1982). If boars are castrated before they reach 6 months of age, treatment with estradiol at 9 months of age results in the immobilization response (standing estrus); however, if castrated after 6 months and treated with estradiol, they show no such female sexual behavior. In sheep, sexual differentiation of the brain for mating behavior occurs between 50 and 80 days of gestation (D'occio and Ford, 1988). The time of sexual differentiation of mating behavior in cattle has not been determined. Studies with bulls indicate that if steroids program or regulate social or sexual behavior, the effect occurs before one month of age (Godfrey et al., 1992). However, some abnormal sexual differentiation of the brain maybe associated with bulling.

In many species, sexual behavior is caused by the conversion of testosterone to estradiol by the enzyme aromatase. Thus, testosterone causes sexual differentiation of sexual behavior and male behavior in genetic males by its conversion to estradiol in the brain and activation of estradiol receptors in cells. Exposure of animals to exogenous androgens or estrogens could alter sexual differentiation or behavior.

Treatment of steers with estradiol increases both male and female sexual behavior. The number of times that steers stood to be mounted and the number of times steers mounted others were greater for steers given estradiol then for steers given testosterone or dihydrotestosterone (Dykeman et al., 1982). Steers treated with either testosterone or estradiol participated in more head butts then non-treated steers. This indicates the both estrogens and androgens can cause both male and female sexual behavior in steers.

In recent study with rams that preferred other rams to ewes, the male orientated rams had reduced concentrations of testosterone and estradiol in serum compared with heterosexual rams (Resko et al., 1996). In addition, the male-orientated rams had a reduced concentration of aromatase in the preoptic area of the brain. Because aromatase converts androgens to estrogens, these results indicate that estrogens may stimulate male behavior in sheep.

Female Receptive Behavior

We do not know if the submissive response (standing to be mounted) of a steer to a more dominant steer differs from normal female receptive behavior. When heifers are estrus or in standing heat, they are restless, mount others and allow themselves to be mounted. Treatment of ovariectomized cows with estradiol causes the standing reaction (Nessan and King, 1981; Cook et al., 1986); treatment of cows with progesterone reduces the effect of estradiol in causing cows to mount others or to stand to be mounted (Davidge et al., 1987). In superovulated cows, maximum concentrations of estradiol at estrus were linearly related to the number of mounts that each cow received (Coe and Allrich, 1989). These studies clearly demonstrate that female sex hormones regulate sexual behavior in cattle. Knowledge of these effects of progesterone and estradiol on female behavior might be useful for developing systems to decrease the incidence of bullers.

Table 1. Plasma estradiol (pg/ml) and testosterone (ng/ml) in buller and normal steers

Expt.	Pen	Hormone	Normal	Bullers
1[a]	1	E2	109.8(6)[b]	42.0(6)
	2	E2	28.0(6)	24.8(6)
	2	T	.3(6)	.2(6)
2	1	E2	6.4(9)	3.8(10)
	2	E2	3.4(7)	2.6(9)

[a] Trt x pen, P< .05 for estradiol.
[b] Number of steers in parentheses.
[c] Trt, P < .08; pen, P < .04.

The social status of dairy heifers in a group also may influence sexual behavior. Weibold and coworkers (1983) found that heifers that were at either the top or the bottom of the social order mounted more heifers that were in estrus and were mounted by more heifers when they were estrus. Thus when new animals are added to a group, increased bulling may occur as the animals reestablish their social status.

Sexual Differentiation of the Bovine Brain

There is no evidence that sexual differentiation occurs in the bovine brain. Both male and female cattle mount others, so gonadal hormones may not cause changes in development which regulate behavior (D'occio and Ford, 1988). Short term exposure of steers to estradiol causes female behavior whereas long term exposure causes male behavior. Perhaps long term exposure of the brain to estrogen results in a refractory response and male aggressive instead of female submissive behavior.

Bower and Kiracofe (1978) found that concentrations of total estrogens were greater in buller steers than in normal steers. In contrast, Irwin and coworkers (1979) found that bullers had reduced concentrations of both estradiol and testosterone in plasma compared with normal steers or bullers that had recovered. Similarly, we found in two experiments with buller steers in different feedlots and different seasons that bullers had lower than normal concentrations of estradiol in plasma (Table 1). Steers in experiment 1 were yearlings that were mostly black or Hereford. Steers were in pens with about 200 other steers. The steers in pen 1 initially were implanted with Synovex and reimplanted with both Synovex (estradiol benzoate and progesterone) and trenbolone acetate (TBA). Steers in pen 2 were implanted with both Synovex and TBA initially because they weighed about 800 pounds when they entered the pen. Greater concentrations of estradiol in both bullers and normal steers in pen 1 than in pen 2 might be due to reimplanting of steers in pen 1. Steers in experiment 2 are desisted in this report in case study 2. Concentrations of testosterone were similar for buller and normal steers. These observations support the hypothesis that exposure to minimal amounts of estradiol may cause animals to be sexually receptive to others whereas exposure to greater amounts of estrogens may cause them to become refractory and not to stand to be mounted.

Investigating Abnormal Behavior (Bullers) in Feedlots

Because estrogens initiate sexual behavior and excess androgens promote masculine behavior, implants often are the first factor accused of causing abnormal feedlot behavior. To try to determine the cause of an increase in the incidence of bullers in a feedlot requires a thorough study. Such an investigation of feedlot behavior should include:

1. a complete history including dates and number of bullers pulled, previous implants, grazing conditions, origins, age and sex of the pen's population, environmental conditions and feedstuffs.

2. physical inspection of implant sites from a representative sample of animals exhibiting abnormal behavior and their normal penmates, detailing variety and number of abnormal implants.

3. physical inspection of the facility to include pen size, bunk space per animal, and stocking density.

4. a description of the management practices to include feeding schedules, bunk management, cattle movements, and the criteria under which bullers are identified and handled.

Information gathered from this type of an investigation should be interpreted in context with the pattern of buller activity. For example, if implants are suspected to cause riding activity, the riding pattern should match the implant hormonal release profile. After implanting hormone concentrations in blood usually reach a maximum within one day, decline rapidly for a week or two, and then continue to decrease until the implant is exhausted. Logically, if the release of hormones from the implant is responsible for riding behavior, the behavior pattern should match this hormonal release profile.

Retrospective examination of the first time buller pulls each day can help discover factors that might incite alterations in animal behavior. Episodes of riding frequently are linked to specific events such as the addition of estrogenic feedstuffs to the ration or the establishment of social order when new cattle are introduced into the pen or neighboring pen. Deficiencies in bunk management may initiate riding at any time during the feeding period; therefore, it is difficult to associate management with a specific pattern. Climatic factors such as season, wide swings in temperature, or barometric pressure also may impact the frequency of bullers.

Examples of Buller Activity in Steers

Case Study 1 (figure 1)

Case study 1 presents data from 3 pens of steers in a small feedlot with an unusually high number of buller pulls occurring in midsummer. Problem pens were identified for investigation. Implant sites were examined on representative buller and non-buller penmates. Pen space, feeding practices, and bunk space were within normal limits. By plotting the occurrence of first time buller pulls, a pattern was identified which appeared to be independent of implants. Further investigation of events relating to changes in feed in the normal step-up procedure indicated that each change in feed predated an upsurge in riding behavior. This correlation was confirmed when the feedlot manager indicated that the silage supply had been exhausted in the summer months and green chop triticale and new crop corn silage had been substituted as a source of forage. Although no forage was included in the receiving ration, it was introduced in the second week at 15.5%, increased to 20% in week three, peaked at 23%, and was reduced to 14% in the final ration. Phytoestrogens in these feedstuffs may have contributed to the abnormal animal behavior.

Case Study 2 (figure 2)

The second case study reflects one pen (a second pen was investigated with similar results) of yearling feedlot steers in the fall. The steers were started on feed after an extended period during which steers grazed native pasture. These animals had not been implanted during the grazing phase. Implant sites were examined on ten animals that had expressed bulling behavior and ten normal penmates. Implanting technique was determined to be satisfactory. The scrotums also were palpated to check for any contribution of deficiencies in castration as a cause of the incidence of riding. Blood was taken for plasma estradiol analysis; results are in Table 1 (pen 2 of experiment 2).

Incidence of buller pulls by days on feed resulted in an erratic pattern that was not related to either implant administration or changes in feed (Figure 3). When changes in total feed delivered to the pen were plotted, it became evident that as total feed delivered to the bunk decreased, the incidence of buller pulls increased. Competition for feedstuffs may have triggered a need to establish social dominance within the group. Concentrations of estradiol in the blood of steers that were being ridden and pulled for buller behavior were less than for their normal pen mates. These hormonal differences indicate that estradiol concentrations may be the result of or contribute to those factors that cause abnormal behavior in feedlot animals.

Treatment of Bullers

Hormones cause sexual behavior in cattle. Will altering the type or amount of hormone stop bulling? Bullers have reduced concentrations of estradiol in plasma compared with riders. We hypothesize that treatment with an androgen or an estrogen may alter the behavior of bullers. Theoretically, additional implants for bullers should alter or reduce buller activity.

Progesterone blocks estrus or the standing reaction in cows. Will treatment of cows with a

synthetic progesterone such as melengestrol acetate (MGA) alter the behavior of bullers? We propose that feeding MGA to buller steers may reduce sexual behavior.

Implications

Sexual behavior is caused by the effect of hormones on the brain of animals. Steers that are bullers appear to have a physiological defect. Thus it seems logical that abnormal sexual behavior, that associated with alterations in plasma concentrations of estradiol, could be treated by hormone therapy. These suggested treatments remain to be tested.

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QUESTIONS & ANSWERS

Question: Would you speculate as to whether the incidence of bullers would be different for animals that have never had an implant versus animals that have had at least three?

Answer: From the evidence that we heard this morning, we conclude that some implants cause greater instances of bullers than others. The occurrence of bullers may be greater in implanted vs. non-implanted steers. However, bullers may not be caused by implants but implants may influence the predisposition that already exists for an animal to be a buller.

Question: You made the conclusion on your case study that perhaps there is some estrogenic compounds from the feed stuffs and yet maybe a dramatic increase in feed intake. Would feed intake have a calming effect?

Answer: We were observing two different scenarios with difference conclusions. One was related to vito estrogens, the other related to consumption and subsequent competition.

Botts: How does the time of castration influence the incidence of bullers?

Answer: I have not seen any data on the effect of time of castration on the incidence of bullers.

Question: Since the bullers have lower estrogen levels, should we reimplanting bullers to reduce the problem?

Answer: That might be something to try. If a heifer or a steer is given estrogen they might show female behavior and then after long term exposure they may exhibit male behavior because they become refractory to estrogen. Maybe steers that are bullers do not have sufficient estrogen. Giving addition estrogen may make the buller steers refractory and they may cease standing to be ridden.

Armbruster: I had a dramatic observation in one of the feedyards I was involved with. One of the most successful times at which bullers could be reintroduced into a pen is reimplanting time. The possibility of that buller animal remaining in the pen is greatly enhanced and if it is reintroduced at the time of reimplanting.

Answer: Steve Armbruster observed in some feedyards that when animals are reimplanted at the time the bullers are reintroduced that this increases the likelihood that the animals can stay in the pen and not have to be pulled again.

Owens: In some personal experiments that are running currently we checked the implant status on a group of steers that have been implanted in a commercial yard. On arrival at OSU it turned out that somewhere between 15 and 20 percent of those had not retained their implant about two weeks after they had been assumed to have the implant. I wonder how the potential for an increase in bullers in large pens might be increased by such a problem. Does the incidence of riding vary with the ratio of the implant's or different size animals in a pen increase riding?

Answer: Some implants have been restricted to certain classes of animals (e.g., feedlot cattle) and for good reason although this may not relate to riding. If all animals in a pen are implanted with the same product, hormone profiles should be similar; thus there should be little reason to initiate abnormal behavior. Theoretically, if animals in a pen are implanted with dissimilar products, hormone profiles should differ and creating more opportunity for riding. In reality, field reports of riding behavior in animals within a pen receiving different types of implant are rare. Certainly, we need more information regarding effects of exogenous hormones on animal behavior.