The Buller-Steer Syndrome

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Bulling among steers is an abnormal behavioral trait and is a common health and economic problem in feedlot operations. Factors associated with the buller-steer syndrome are hormonal implantation, seasonality and environmental conditions, stress, overcrowding, and social interaction between individuals. Research has examined relationships between these and other factors and buller occurrence. Boredom of feedlot cattle may contribute to buller occurrence and other undesirable behavior more than we might suspect. Research is needed to determine the feasibility of enriching the environment of penned livestock in general, the goal of which would be, in theory, the elimination of undesirable behavior as well as increased performance.

Introduction

The buller-steer syndrome is described as an abnormal behavioral trait where steers and bulls are confined in large numbers. The typical buller-steer sexually attracts his penmates, who take turns following and mounting the abnormal animal. To complicate matters, there appear to be various degrees to bulling activity. Some riding activity is relatively harmless and falls under the category of "horseplay." On the other end of the spectrum we have serious bulling activity in which normal steers vigorously pursue the abnormal steer, the buller, who may or may not be receptive to his tormentors. Escape is occasionally made over and through the feedbunk or fence.

Many factors have been associated with the buller-steer syndrome: Hormonal implants, seasonality and environmental conditions, overcrowding, stress, pheromones, and social interaction between individuals. Several of these factors have come into play as a result of the prolonged captivity of ancestral species, which is necessary to the process of domestication. In Hafez's text, *The Behaviour of Domestic Animals* (1975), domestication is defined as the removal of an organism from some natural selection pressures over generations. Changes in a species which result from domestication are said to be the consequence of the effects of captivity, and eventually bring about a change in genotype. Hafez (1975) suggests that captivity is a more powerful agent of behavioral change than might be imagined. For example, Russian researchers have described a destabilization of genotype in captivity with a rapid breakdown of the system created by centuries of natural selection in mink and silver foxes (Hafez, 1975).

Captivity removes animals from many natural selection pressures and introduces new stresses. Captivity results in boredom, invasion of personal space and ritualized games. The tendency in natural species of cattle for individuals to space themselves apart must either be modified or express itself in abnormal behavior. This can be illustrated by the distinction found between the behavior of penned livestock and those pasturing or on open range, which more closely resemble "natural" conditions. The latter are relatively free to graze and meander, and to maintain a distance between individuals if desired (R. Ulbrich, personal observation). Farmers and ranchers have long recognized the presence of bullers, but under pasture or range conditions the buller-steer presents no serious difficulty. As feedlots have increased in number and size, so have bullers and the resulting problems (Brower and Kiracofe, 1978).

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Factors Associated with the Buller-Steer Syndrome

Social hierarchy

One might suspect the underlying cause of this abnormal behavior to be the social hierarchy, or "pecking order" relationships, which are established among individuals. The submissive behavior of the buller-steer may be the result of the adverse effect of the intensity of social interactions, as suggested by the increased occurrence of bulling activity in pens made up of several groups of newly introduced cattle (Irwin *et al.*, 1979). Brower and Kiracofe (1978) report that not all bullers fit into the classical buller syndrome. Some are the target of aggression and may be at the bottom of the social strata.

In most cases, however, individual social rank among beef cattle does not appear to be the cause of the buller-steer syndrome. Studies reported by Pierson *et al.* (1976) indicate that veterinarians and feedlot employees have observed that bullers may be the biggest, most aggressive steers in the pen or, by contrast, the ones at the bottom of the pecking order.

Hormonal implants and oral DES

Gassner *et al.* (1958) reported that treatment of feedlot steers with estrogen resulted in undesirable side effects including feminization, high tailheads, and bulling. Further, bulling activity occurred 1 to 3 days after DES implantation and continued for 1 to 2 weeks.

Pierson *et al.* (1976) analyzed the relationship between the occurrence of bulling and hormonal implantation in 4 Colorado feedlots (Table 1). Prior to 1971,

TABLE 1—Annual Percentage of Bullers and Anabolic Agent Used 1968-1974

Year	Total cattle fed	Bullers (No.)	Bullers (%)	Anabolic agent used per animal
1968	264,174	3,673	1.39	10mg DES in feed
1969	296,782	3,766	1.27	10mg DES in feed
1970	359,683	6,403	1.78	10mg DES in feed
Total	920,639	13,842		
Mean (%)			(1.50)	
1971	15,546	10,782	2.09	20mg DES in feed
1972	554,361	15,532	2.80	20mg DES in feed and implant
1973	431,761	13,639	3.16	20mg DES in feed and implant
1974	407,450	14,960	3.67	20mg DES in feed and implant
Total	1,90,118	54,913		
Mean (%)			(2.88)	

DES = Diethylstilbestrol.

Taken from "Bulling Among Yearling Feedlot Steers", R.E. Pierson *et al., JAVMA 169*:521-523.

diethylstilbestrol (DES) was fed at the rate of 10mg per head, and from 1971 to 1974 at the increased rate of 20mg per head. Beginning in 1972, 3 different hormones were used in addition to oral DES. During 1973, the 3 hormones were evaluated by alternately using them on groups of about 400 head until over 160,000 cattle were implanted with 1 of the 3 products. Finally, one of them was selected for its ability to produce efficient weight gains, specifically Synovex-S. During 1974, steers fed for 60 days or less were implanted once. Cattle fed for longer periods were implanted twice. All cattle were given 70mg of antibiotic daily in their feed. Hormone implants and vaccinations for IBR (infectious bovine rhinitis) and leptospirosis were given to all cattle within 10 days of entry at the feedlot.

From 1968 to 1970, when DES was fed as the only anabolic agent, the percentage of bullers fluctuated from 1.27 to 1.78 for the three year period. During this time the daily dosage of DES and hormone implants were used simultaneously.

When the 3 different hormones were compared for feed conversion and weight gains in 1973, there was a difference in the occurrence of bulling. The implant associated with the better weight gains appears to produce the greatest incidence of bulling (Pierson *et al.*, 1976). Nevertheless, it was selected and used exclusively in 1974 (Table 2).

Irwin *et al.* (1979) reported that under certain circumstances, the use of growth-promoting hormonal implants has been found to be related to increased incidence of the buller-steer syndrome. The highest percentage of bullers was found to result from implantation of the progesterone-estradiol product Synovex-S, which also produced the most desirable live weight gains, as was the case in the aforementioned study. Similarly, an increase in the oral dose of DES from 10mg to 20mg was found to result in a slight increase in annual incidence, which increased further when the Synovex implant was used while feeding DES at the higher dosage.

TABLE 2— Relationship of Bullers to Brand of Implant

Implant	Dosage (mg)	No. of cattle implanted	Bullers (No.)	Bullers (%)
DES*	30	68,086	1,729	2.54
Zearalanol**	36	51,216	1,123	2.19
Progesterone & estradiol†	20	42,020	1,691	4.02

*Stilpel, Fort Dodge Laboratories, Fort Dodge, IA.
**Ralgro, Commercial Solvents Corporation, Terre Haute, IN.
†Synovex-S, Syntex Laboratories, Inc., Animal Health Division, Des Moines, IA.

Taken from "Bulling Among Yearling Feedlot Steers", R.E. Pierson *et al., JAVMA 169*:512-523.

It should be emphasized that the use of growth promoting hormones, even though they play a significant role in the syndrome, has not been entirely responsible for the occurrence of bulling, as typical buller-steers are observed in feedlots

where implants are not used (Irwin *et al.*, 1979). In any event, it should be noted that administration of DES to beef cattle in the research cited above had taken place before the 1 November 1979 ban on implantation and oral dosing of DES in food animals by the Food and Drug Administration (FDA). Although Synovex-S has been approved by the FDA for use in feedlot cattle with implantation at least 60 days before slaughter (*USDA Agricultural Research 29*(9), May 1981), this factor should play a lesser role in more current analyses of the syndrome.

Seasonal frequency

Pierson *et al.* (1976) report that seasonal frequency of bulling at 4 Colorado feedlots was constant from 1968 to 1974. Twice as may bullers were seen and removed in the summer and fall than in winter and spring (Table 3). The period of increased bulling coincided with the feeding of green chopped alfalfa. It is suggested that this was due to the coumesterol content in the fresh alfalfa. (Coumesterol is an estrogenic compound which accumulates in alfalfa when fungal pathogens damge the leaves *[*Pierson *et al.*, 1976*]*.)

Brower and Kiracofe (1978) reported more bullers in July and August than any other months. The type of ration fed was not discussed.

However, the studies of Irwin *et al.* (1979) demonstrated a marked increase in buller frequency during November and December, which may have been associated with the increased number of cattle entering the feedlot at this time.

TABLE 3— Seasonal Trends for Frequency of Buller Steers 1968-74

	Winter		Spring	
Year	No. of Feed	Buller %	No. of Feed	Buller %
1968	87,137	.63	87,797	.43
1969	100,753	.59	103,411	.41
1970	110,481	.74	129,713	.58
1971	170,464	1.10	201,340	.94
1972	204,116	1.45	216,556	1.48
1973	195,383	.90	189,180	.90
1974	182,528	1.48	182,068	1.86
Mean %		1.07		1.05

	Summer		Fall	
Year	No. of Feed	Buller %	No. of Feed	Buller %
1968	90,393	1.21	102,802	1.61
1969	102,234	1.07	118,322	1.26
1970	172,077	1.12	196,424	1.48
1971	206,201	1.37	212,524	2.00
1972	223,455	1.85	221,529	2.37
1973	210,467	2.16	213,186	2.64
1974	143,814	3.93	151,391	2.21
Mean %		1.85		1.77

Taken from "Bulling Among Yearling Feedlot Steers", R.E. Pierson *et al.*, *JAVMA 169*:521-523.

Weather

A questionnaire to assess the occurrence, economic impact, and possible causes of the buller-steer syndrome was sent to members of the Kansas Cattle Feeders Council. According to the response, occurrence of bullers was associated with a seasonal or environmental factor such as changing or wet, stormy weather (Brower and Kiracofe, 1978). The number of steers represented was about 20% of the steers on feed in Kansas according to a 1971 United States Department of Agriculture reference (USDA, 1971).

Irwin *et al.* (1979) report findings to the contrary, however. Weather conditions during each day of the week prior to and on the first day of bulling were found to have no relationship to the occurrence of bulling.

Entry weight or size

The entry weight of steers has no effect on buller frequency. The major occurrence was in the same weight range as that for most of the incoming steers (Irwin *et al.*, 1979).

Overcrowding

Three years of records for ten pens of varying sizes involving nearly 11,000 steers were analyzed to determine the effect of overcrowding. Buller frequency was not significantly increased by pen space per head or weight of cattle. For every 10 head increase in total head per pen, the buller incidence increased .015%. For every 9.3 square meters increase in pen size the buller rate decreased .05% (Brower and Kiracofe, 1978).

Irwin *et al.* (1979) found no statistical correlation between buller occurrence and either pen size or square meters per head. Results suggested that as the number of steers per pen increased, irrespective of pen space available, there was a corresponding increase in buller occurrence.

Stress

Stress factors which contribute to buller incidence include changes in environment, routine, and diet, plus handling and transportation of steers to the feedlot. Once cattle are acclimated to feedlot conditions, contributory factors include switching pens, changes in feed routine, and lack of feed (Brower and Kiracofe, 1978).

When the feedman is unable to perform his duties, during a feed mill breakdown, for example, many cattle line up to empty feedbunks in anticipation and are easily excitable. Riding activity is seen to increase and usually persists until the feed situation is corrected (R. Ulbrich, personal observation).

Pheromones

The pathogenesis of the buller-steer syndrome has been considered to involve increased blood concentration of estrogenic hormone, with expression of estrous mounting behavior (Brower and Kiracofe, 1974). Brower and Kiracofe (1972) reported buller-steers to have higher urinary estrogen levels than normal steers. The effeminate behavior of the buller-steer suggests an estrogenic influence, which is supported by the observation of high serum and urinary total estrogens in previous investigations (Brower and Kiracofe, 1974).

Gassner *et al.* (1958) implicated a sex odor as an attractant to penmates by

showing that bulling behavior increased when the buller was injected with estrogen, but decreased with treatment of testosterone. The sexual stimulation of the rider is due indirectly to the olfactory stimulation associated with the release of pheromones by the buller (Irwin *et al.*, 1979). However, the visual stimulus of the buller's stance may be responsible for provoking the mounting behavior, as seen with bulls mounting tethered steers for semen collection (Hafez, 1969).

Serum estradiol and testosterone values were obtained from Synovex-S implanted buller-steers by Irwin *et al.* (1979) at the time of bulling and during a recovery phase. Both gonadal hormones assayed were lower while the steers were bulling than at the end of three days' isolation. The conclusion reached was that the expression of a gonadal hormone may not be responsible for the abnormal behavior.

A pheromone investigation was conducted by Brower and Kiracofe (1978). Urine and feces were collected from overt bullers and normal steers. Buller and nonbuller urine were applied in bags to the tailheads of normal steers. Response of penmates ranged from attempted mountings to no recognition. The latter seemed to be mostly curious about the bags on the steer's rumps. However, more attention was paid to the steers with the buller urine. In all cases experimental steers resisted mounting and engaged in aggressive butting. Buller feces applied to normal steers resulted in minor attention but no attempted mountings.

The results of this experiment would seem to indicate the presence of pheromones. The mechanism by which DES and other growth promoting products result in pheromone secretion is unclear.

Economic Impact

Although the buller-steer syndrome has been known to exist for several years, it has only recently been reported to be of significant monetary importance (Irwin *et al.*, 1979). A 2 to 3% annual incidence is reported in steers fed in Colorado (Pierson *et al.*, 1976) and in Kansas feedlots (Brower and Kiracofe, 1978). Respondents to the Kansas questionnaire estimated that the bullers represented a minimum loss of $23.00 each. Financial loss involved not only additional labor, facilities, bookkeeping, rations and injury, but also unfavorable public relations. The feedlot operators indicated that buller-steers were enough of a problem to justify spending 5 to 6 dollars per head if a treatment were available (Brower and Kiracofe, 1978).

Pierson *et al.* (1976) report that although riding may continue until the bullers become exhausted, collapse, and die, the main economic loss results from injury of the buller and stress to both buller and rider, and the necessity of early isolation of the victim. However, in the case of a buller fatality, not only does the owner forfeit the animal's cost or worth, someone must stand the loss of the dead animal's accumulative feed—possibly as much as $200 if nearly finished (R. Ulbrich, personal observation).

Percentage of injuries from bulling coincided with the seasonal occurrence in 4 Colorado feedlots. During 1974, out of almost 2,000 necropsies, it was determined that 83 steers (3.8%) died from riding injuries—18 immediately and 65 after treatment for fractures, contusions, cellulitis, and pneumonia (Pierson *et al.*, 1976). It should be noted that the above figures would not include possible carcass losses upon slaughter of surviving bullers, due to bruises and discoloration, which necessitate trimming of the carcass especially in the loin area, the most valuable carcass component (E. Snyder, feedlot operator, personal communication).

General Observations

The Kansas survey indicated that the syndrome was not associated with a particular breed, an age or weight class or origin of cattle. Not all bullers fit into the classical buller syndrome. Some are the target of aggression and may be at the bottom of the social strata. In spite of the traumatic experience, the bullers, once segregated, gained as rapidly as their original penmates and were marketed at the same time. Once bullers are removed to a separate pen very little riding occurs, even though the number and density of bullers may be relatively high (Brower and Kiracofe, 1978).

Some steers become bullers because they are debilitated by disease. Once mounting is initiated, it usually continues until the buller is removed (Pierson *et al.*, 1979). The behavior of the buller-steer should not be confused with brief random mounting of individual steers under close confinement (Irwin *et al.*, 1979).

Prevention

Other than common sense management practices, such as adherence to feeding routines and rations, proper handling, and taking steps to avoid stress, the literature suggests little in the way of prevention.

Simple boredom of feedlot steers may play a larger role in the buller-steer syndrome than we may realize (R. Ulbrich, personal observation). Such a notion would be difficult to prove. Conner is cited (Hafez, 1975) as remarking that no controlled studies of behavior have been conducted to seperate genetic and environmental factors of domestication. Animals in their natural state are seen to spend a large portion of their waking hours in the procurement of food. In our ever increasingly intensive livestock systems, we have provided animals with an adequate food supply, without paying much attention to their behavioral needs (Adler, 1976). The barren, monotonous environment of a corral or pen provides an ideal setting for the development of undesirable, sometimes destructive abnormal behavioral traits, as seen with "cribbing" horses and feedlot buller-steers (R. Ulbrich, personal observation). The domestication process has not sufficiently addressed itself to the problem of boredom.

Background music is recommended for all types of livestock in stockyards and slaughter plants to relax animals and cover machinery noise (Grandin, 1980). Perhaps we should apply this type of treatment to the buller-steer problem and thus proceed one step further.

There is a need for the development of a practical manner in which to entertain or at least engage the attention of feedlot cattle and penned livestock in general. In theory, research in this area would have as its goal the elimination of undesirable, abnormal behavior as well as increased performance.

Conclusions

The buller-steer syndrome is a common health and economic problem in feedlot operations, and appears to be increasing in annual incidence. Intangible monetary losses per buller are estimated at about $23. If unchecked, bullers perform poorly, if indeed they survive, and the agitation of their penmates undermines the performance of the entire pen. Research has demonstrated the abnormal behavior to be associated with the following: hormonal implants, improper implantation technique, the feeding of fresh alfalfa, stress, and pheromones in some cases. Incidence has been shown to be unrelated to weather conditions, overcrowding,

and weight of cattle. Upon detection, bullers are segregated and treated for injury or illness. In most cases, subsequent riding and injury in "buller pens" is minimal.

To the extent that boredom of feedlot cattle results in abnormal behavior, research should be initiated to explore the feasibility of enriching the environment, possibly by visually engaging the attention, in some manner, of feedlot cattle and penned livestock in general.

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