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Abstract

A grazing/feedlot field study was conducted to evaluate the steroid hormone profile and brain monoamine oxidase type A (MAOA) activity of steers exhibiting characteristics attributed to the Buller Steer Syndrome in a feedlot environment. Differences of serum progesterone, testosterone, and estrogen were found in bullers at different phases of production. Brain MAO-A activity was greater in bullers than in non-bulling steers. This study suggests that MAO-A activity, under potential influence of steroidal hormones in the steer brain, may be a plausible mechanism that induces Buller Steer Syndrome.

Keywords

Cattlemen's Day, 2004; Kansas Agricultural Experiment Station contribution; no. 04-242-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 923; Beef; Steroid; Brain monoamine oxidase type A (MAO-A) activity; Buller steers

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STEROID HORMONE PROFILES AND BRAIN MONOAMINE OXIDASE TYPE A (MAO-A) ACTIVITY OF BULLER STEERS

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Summary

A grazing/feedlot field study was conducted to evaluate the steroid hormone profile and brain monoamine oxidase type A (MAO-A) activity of steers exhibiting characteristics attributed to the Buller Steer Syndrome in a feedlot environment. Differences of serum progesterone, testosterone, and estrogen were found in bullers at different phases of production. Brain MAO-A activity was greater in bullers than in non-bulling steers. This study suggests that MAO-A activity, under potential influence of steroidal hormones in the steer brain, may be a plausible mechanism that induces Buller Steer Syndrome.

Introduction

The Buller Steer Syndrome is a behavioral condition normally encountered in a feedlot setting in which several steers within a pen will persistently ride one or sometimes two steers within a small group. Although the syndrome is more prevalent in a feedlot setting, it may also occur in pastures. The National Animal Health Monitoring System (NAHMS) 1999 beef feedlot survey reported that incidence of bullers ranked as the second most prevalent disease in feedlots (2.2% of all cattle) behind conditions of Bovine Respiratory Disease (USDA, 2002).

Bulling behavior is economically detrimental to the cattle-feeding industry. Recent estimates place the cost of bulling to the cattle industry between $23 and $70 per buller.

Several different mechanisms have been postulated to trigger Buller Steer Syndrome. These include social hierarchy, growth implants, weather, season of the year, poor bunk management, pen size and density, entry weight and/or age, pheromones, and phytoestrogenic substances in the feed. Although all of these factors may play a role in eliciting the bulling behavior, there has been no agreement that any one factor may exclusively cause it.

Monoamine oxidase (MAO) is an enzyme that can be located throughout the body, but it plays a role in the regulation of behavior, dependent on the amount in the brain. Like any enzyme in the body, MAO is needed in an appropriate amount so that an individual can function properly. Too much or too little of an enzyme can have a direct impact on an individual's health and personality. In humans, a relationship has been established between undesirable social behavior and monoamine oxidase type A (MAO-A) activity. The expression of MAO has been found to be concurrent with the genotyping ability of an organism to produce the enzyme, and transcriptional regulation of MAO can come under modulation from steroidal hormones. Very

[1]Sincere appreciation is expressed to Pratt Feeders, Pratt, Kansas, and Irsik and Doll Feedlots, Cimarron, Kansas, for providing cattle, facilities, and financial support.

recently, subordinate mice were reported to have significantly greater amounts of MAO-A mRNAs when compared with normal counterparts.

The objective of this study was to evaluate steroidal hormone levels of steers at three different production phases and to measure brain MAO-A mRNA activity in the frontal cortex of buller and non-buller steers.

Experimental Procedures

Sera were harvested from 600 crossbred steers of eastern Missouri origin 7 to 14 days before placement on five different intensive early stocked pastures (pre-grass) in south central Kansas. In mid to late July of 2002, all steers were sent directly to a commercial feedlot in western Kansas (initial body weight 887 lb), where serum was again harvested from all steers (feedlot arrival). Each pasture group was maintained as a separate pen. When any steer was removed from its home pen for exhibiting classic buller-steer characteristics, blood was collected from that animal (buller) before moving it to a separate pen. For the MAO-A analysis, brains were harvested at the end of the feeding period from 12 buller and 12 non-buller steers at a commercial packing plant.

Results and Discussion

A total of 27 steers were classified as bullers during the feedlot period. Pre-grass progesterone was less ($P<0.05$) in sera obtained from buller compared with non-buller sera (Figure 1). From feedlot arrival to buller, there was a reduction ($P<0.05$) of progesterone in buller steers. There was an increase ($P<0.01$) of testosterone in buller steers from feedlot arrival to buller (Figure 2). Estrogen increased ($P<0.01$) from pre-grass to feedlot arrival in both buller and non-buller steers (Figure 3). This is an expected difference, because the implant given at the pre-grass time would still be releasing estrogen. Brain MAO-A mRNA levels were 74.5% greater ($P=0.03$) in buller than in non-buller steers (Figure 4). Western blots have confirmed the presence of MAO-A protein in brain samples (Figure 5).

These data indicate that MAO-A activity in the frontal cortex region of some buller animals differs from non-buller steers. More research is needed to see if a direct correlation exists between the differences in systemic steroidal hormone levels and MAO-A activity in the bovine brain.

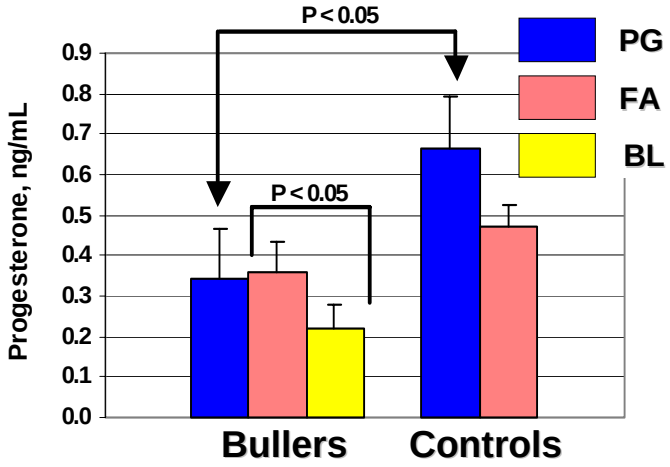

Figure 1. Progesterone Levels of Bullers vs. Controls (Non-Bullers) at Different Phases of Production. Time of sampling: PG = Pre-grass; FA = Feedlot arrival; BL = Buller.

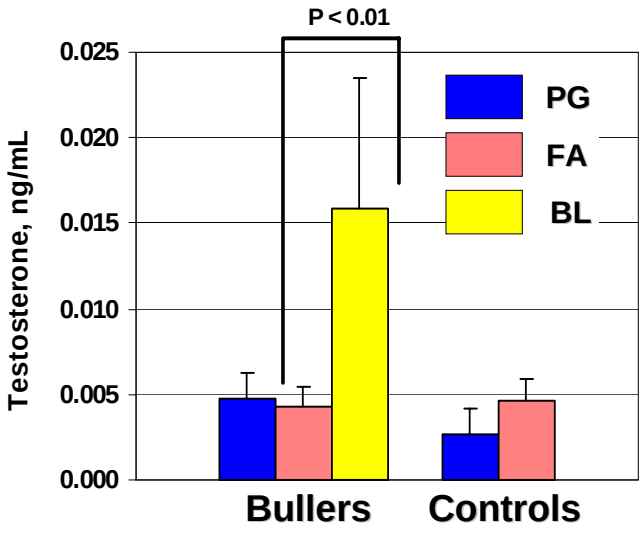

Figure 2. Testosterone Levels of Bullers vs. Controls (Non-Bullers) at Different Phases of Production. Time of sampling: PG = Pre-grass; FA = Feedlot arrival; BL = Buller.

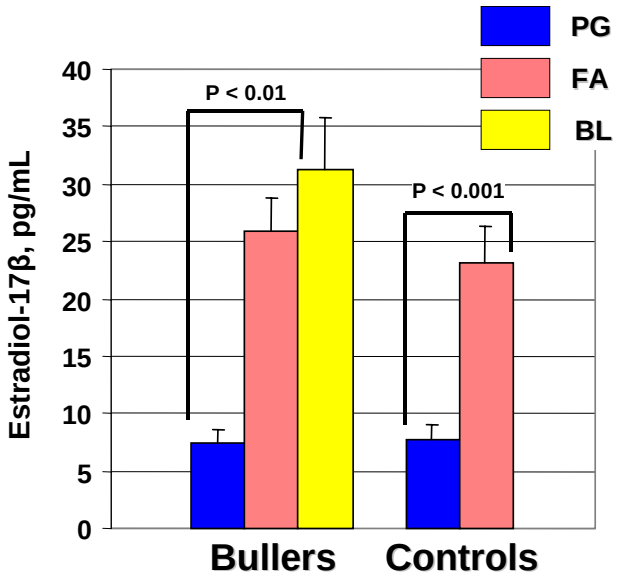

Figure 3. Estradiol-17ß Levels of Bullers vs. Controls (Non-Bullers) at Different Phases of Production. Time of sampling: PG = Pre-grass; FA = Feedlot arrival; BL = Buller.

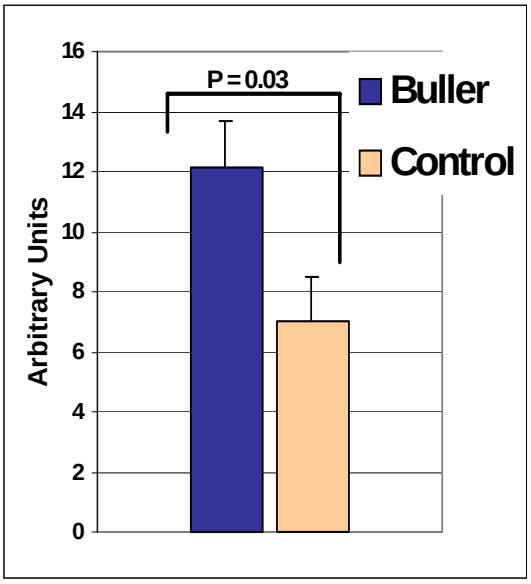

Figure 4. Brain mRNA MAO-A Levels of Bullers vs. Controls (Non-Bullers).

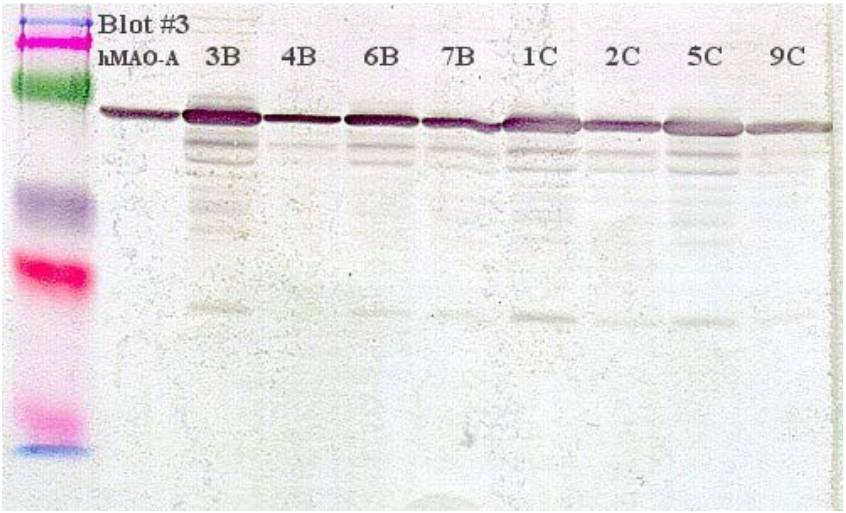

Figure 5. Western Blot Representing that Protein has been Translated (i.e., been made) from mRNA. The band labeled hMAO-A is human MAO-A and is used as a positive control. Labels 3B, 4B, 6B, 7B are buller steers and 1C, 2C, 5C, 9C are control (non-buller) steers. Notice that buller steer bands are darker than controls, an indicator that MAO-A protein may be in larger quantities.