IMPACT OF SOCIAL MIXING ON FEEDLOT STEER BEHAVIOR

An Undergraduate Research Scholars Thesis

by

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TABLE OF CONTENTS

ABSTRACT

Impact of Social Mixing on Feedlot Steer Behavior

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Angus crossbred steers from two genetically similar sources (n = 48 BCS and n = 48 McG), were transported separately (833.64 ± 85.29 km) 39-d prior to commingling and housed at a feedlot without visual or tactile contact. Steers, blocked by source and d -34 body weight, were randomly assigned to 12 pens (n = 8 steers/pen). Pens housed either: NOMIX—100% from BCS (n=3 pens) or McG (n=3 pens) or MIX—50% from BCS and 50% from McG (n = 6 pens). Video recordings were decoded on d 0, 1, and 2 for the number of agonistic behaviors, allogrooming bouts, and drinking bouts initiated by each steer during the first four hours post-mixing. Rumination behavior was recorded on d 1, 2, and 3 post mixing. Mixed models evaluated the impact of treatment, day, and their interaction on cattle behavior. Orthogonal contrasts compared the impact of source on performance of each behavior and Pearson correlations were used to compare total performance of each behavior throughout the study. NOMIX steers performed more ($P = 0.08$) drinking bouts (10.54 ± 1.27 bouts/steer/pen) than

MIX steers (7.68 ± 1.05 bouts/steer/pen). Steers ruminated less on d 3 (NOMIX: 7.97 ± 0.29 hours/steer/day MIX: 8.06 ± 0.29 h/steer/d) than on d 1 (NOMIX: 8.55 ± 0.29 h/steer/d MIX: 8.22 ± 0.29 h/steer/d) or d 2 (NOMIX: 8.77 ± 0.29 h/steer/d MIX: 8.46 ± 0.29 h/steer/d) across all treatments. Steers in MIX pens (7.81±0.30 h/steer/d) spent more time ruminating than steers in NOMIX pens from McG (7.46±0.47 h/steer/d) than steers in NOMIX pens from BCS (8.39±0.52 h/steer/d). NOMIX pens initiated more ($P < 0.01$) headbutts overall (1.98 ± 0.13 count/steer/pen) and mounts on d 2 (1.07 ± 0.11 count/steer/pen) than those in MIX pens (1.30 ± 0.18 and 0.39 ± 0.15, respectively). Social mixing reduced agonistic behavior and may cause cattle to take longer to establish social hierarchies. Social mixing also decreases drinking behavior and delays social hierarchy establishment.

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NOMENCLATURE

BCS	Texas A&M Beef Cattle Systems
McG	McGregor
d	Day
h	Hour(s)
NOMIX	No Mix
MIX	Mix

CHAPTER I

INTRODUCTION

In the beef industry, cattle typically move through three different sectors of the industry (e.g., cow-calf operations, stocker/backgrounding operations, and/or auctions) before they enter a feedlot. At each step, cattle may be socially mixed (i.e., when multiple unfamiliar sources are grouped together into one new group) to form groups that are more uniform in nature (e.g., similar body weights, sex, age, or production status). There are many stressors associated with transporting cattle to new locations and social mixing which include negative impacts on metabolism, appetite, growth rate, rumen health, digestion, and the immune system (Loerch, 1999). Thus, accurately quantifying the impact of social mixing, which is a common beef industry practice on the performance of drinking behavior, time cattle spend ruminating, and performance of social behaviors will provide a more conclusive insight to beef cattle welfare in feedlots.

Drinking Behavior

In cow-calf and stocker operations, sources of water can include any combination of water troughs and ponds. However, feedlot operations generally only have water troughs as a source of water. Cattle are a gregarious species, thus they generally surround water sources at similar times, even if they are not actively drinking (Capik et al., 2017). This makes it difficult to detect if an animal actually drinks water from the source, or if they are simply within close proximity to it. New methods for more accurately identifying drinking behavior for feedlot cattle in particular are being developed in order to combat this issue. Real time location systems can assist in characterizing how often cattle approach and time spent around a water source (Shane et al., 2016). Other methods that have been utilized to record amount of time around a water source include the use of motion detectors, accelerometers and weight triggered plates (Williams et al., 2020; Ruuska et al., 2016). However, these systems only provide information about time spent in proximity to water sources, not information about if an animal is drinking or not. Another technology that is being developed to quantify water intake that might provide some information about cattle drinking behavior is reticulorumen temperature boluses. These boluses quantify drinking behavior in cattle through the change in rumen temperature associated with water intake (Vázquez-Diosdado et al., 2019). However, these boluses would only be able to provide information about when water was consumed and not be able to provide information about time spent around a waterer or what drinking behavior looks like. Currently, the only validated way to record drinking behavior is through human observation, which is both time consuming and requires a large amount of labor to capture.

The limitations of collecting cattle drinking behavior data have led to many studies only collecting information about the time cattle spend in proximity to waterers (Shane et al., 2016). Thus, there is little information available regarding actual cattle drinking behavior. Additionally, much of the research regarding the time cattle spend in proximity to waterers has mainly been conducted in dairy cattle (Ruuska et al., 2016). Thus, there is a dearth of information about the drinking behavior of beef cattle overall and when cattle are in feedlots.

Rumination Behavior

Rumination (i.e., the process by which cattle regurgitate swallowed food and chew it a second time) is influenced by many factors including stress. Some other factors that influence the amount of time cattle spend ruminating are nutrient content of the diet, access to feed, disruptions such as human interaction or unusual weather, sickness, and the amount and size of roughage consumed. Albright (1993), suggested that palatability may affect rumination, as cattle have highly developed senses of taste.

New sensor-based technologies that quantify rumination behavior have led to significant gains in understanding rumination's role in feedlot cattle welfare and the extent to which any of the factors above impact the time cattle spend ruminating. These technologies have been developed for use in ear tags, nose bands, or collars and quantify either small movements associated with rumination (e.g., ear or jaw movement) or the sound of regurgitation of a food bolus (Ruuska et al. 2016). Through this technology, Kilgour (2012) discovered that cattle tend to ruminate while laying down and is typically performed overnight. Further, when cattle arrive at a feedlot, they are experiencing a multitude of stressors which may include the changes in diet and feed access mentioned above. The combination of these stressors over a short period of time can predispose cattle to bovine respiratory disease (Tomczak, 2019) which can lead to reduced feed intake which is associated with less time spent ruminating. Thus, rumination behavior may be negatively impacted by illness and could be used as an indicator for illnesses in cattle (Braun, 2013). Therefore, understanding how rumination behavior is impacted by social instability can lead to greater understanding of how psychological stressors like social mixing impact the amount of time cattle spend ruminating and welfare.

Agonistic Behavior

Cattle are a gregarious species and form social hierarchies within groups; when cattle are socially mixed, they re-establish social hierarchies through agonistic behaviors (Lamb, 1976). Agonistic behavior can be characterized by displacement from the feed bunk or water trough, mounting, single time headbutts, or an extended headbutt that can turn into fighting (Bouissou et al., 2001). Increased agonistic behavior can potentially lead to economic loss to the producer, as it can produce both direct and indirect consequences; direct consequences include injuries sustained by fighting, and indirect consequences include negative physiological changes due to heightened social stress (Mench, 1990). Thus, quantifying the time for agonistic behavior to stabilize after social mixing can provide information regarding latency to social hierarchy formation and the impact social instability has on productivity.

Objectives

The objectives of this project are to measure how social mixing impacts feedlot cattle drinking, rumination, and agonistic behaviors. Drinking behavior has not been recorded with great accuracy in past research, so this project aims to improve upon this through continuous observation. Rumination is another behavior that is directly correlated to the health of the steer, and is therefore useful in determining the welfare of the current industry standard of social mixing. While drinking and rumination are inherent behaviors that are critical for survival, agonistic behavior is a luxury behavior that do not directly impact survival. Measuring agonistic behavior post-social mixing and comparing that to the control will help to give a better insight into the overall welfare of the herd.

CHAPTER II

METHODS

All procedures for this study were approved by West Texas A&M University/Cooperative Research, Educational and Extension Team Institutional Animal Care and Use Committee (IACUC 02-09-18). The study took place across a 7-week period in January and February of 2019.

Animals and Housing

Angus crossbred steers (n = 96) of similar genetic composition and age were weaned and backgrounded at the McGregor AgriLife Research Station (n = 48; McG) and Texas A&M Beef Cattle Systems (n = 48; BCS). Each source was shipped via separate trucks on d -42 to the Texas A&M Bushland Research Feedlot in Bushland, TX. Upon arrival, cattle remained in their original groups and were housed in pens where they did not have tactile or visual contact. Five days after arrival, sources were processed separately, and each steer was fitted with an ear tag (Allflex Livestock Intelligence). Steers were blocked by source and stratified by d -39 body weight before being randomly assigned to one of 12 pens (n = 8 steers/pen) that provided an average of 19.5 m^2 pen space and 1.37 m of linear bunk space per steer. Steers were fed once daily a grower ration and had *ad libitum* access to water. The same grower ration was fed from arrival to the end of the study.

Each pen was assigned to one of two treatments (n = 6 pens/treatment): 1) NOMIX - 100% of cattle sourced from either McGregor (McG) (n = 3 pens; n = 24 steers) or 100% of cattle from BCS (n = 3 pens; n = 24 steers) and, 2) MIX - 50% of cattle sourced from BCS and 50% from McG (MIX) (n = 6 pens; n = 24 BCS steers and n = 24 McG steers).

Data Collection

Video based behavior observations were conducted by trained observers on the day of social mixing (d 0) and two days following (d 1, 2). On d 0, steers within each source were weighed and fitted with a colored collar for unique identification before being placed into their assigned pens. Logistical limitations prohibited all animals from being placed in their socially mixed pens simultaneously as the cattle sorting process can take time. Therefore, behavior observations were conducted on the four hours after the last steer was sorted into a pen. The same four-hour time period was used to record behavior on d 1 and 2 after mixing.

Continuous behavior observations measured the frequency that steers initiated and received headbutts, mounts, and feedbunk and waterer displacements; additionally, the frequency and duration in which steers performed drinking bouts was also recorded (Table 1).

Table 1: Ethogram of behaviors recorded during behavior observations.

Behavior	Description
Drinking	One animal has their nose in the waterer; starts when an animal places their nose in the waterer and ends when the animal moves their nose out of the waterer
Headbutt	One animal (the actor) makes contact with another animal (the recipient) forcefully using their head
Mount	One animal (the actor) places their torso on the topline of another animal (the recipient)
Feed Bunk Displacement	One animal (the actor) causes another animal (the recipient) to back away from the feedbunk)
Waterer Displacement	One animal (the actor) causes another animal (the recipient) to back away from the waterer

Rumination behavior was measured via AllFlex rumination ear tags (AllFlex Livestock Intelligence, Madison, WI, USA) that utilized accelerometers to record rumination bout frequency and duration. Rumination behavior was examined on days 1, 2, and 3 following mixing due to steers being handled and processed on the day of mixing thus causing variations in the amount of time cattle steers had access to feed.

Data Analysis

Pen was the experimental unit for all analyses. Effect of treatment, day, and treatment × day on the time steers spent ruminating, number of drinking bouts, and the frequency of initiation of each agonistic behavior by steers were evaluated with linear mixed models (PROC MIXED, SAS v9.4). The model included day as the repeated effect and steer within pen as the random effect. Orthogonal contrasts were used to analyze linear quadratic effects of source on the response variables. Pearson correlations (PROC CORR, SAS v9.4) were used to compare the total number of each behavior performed.

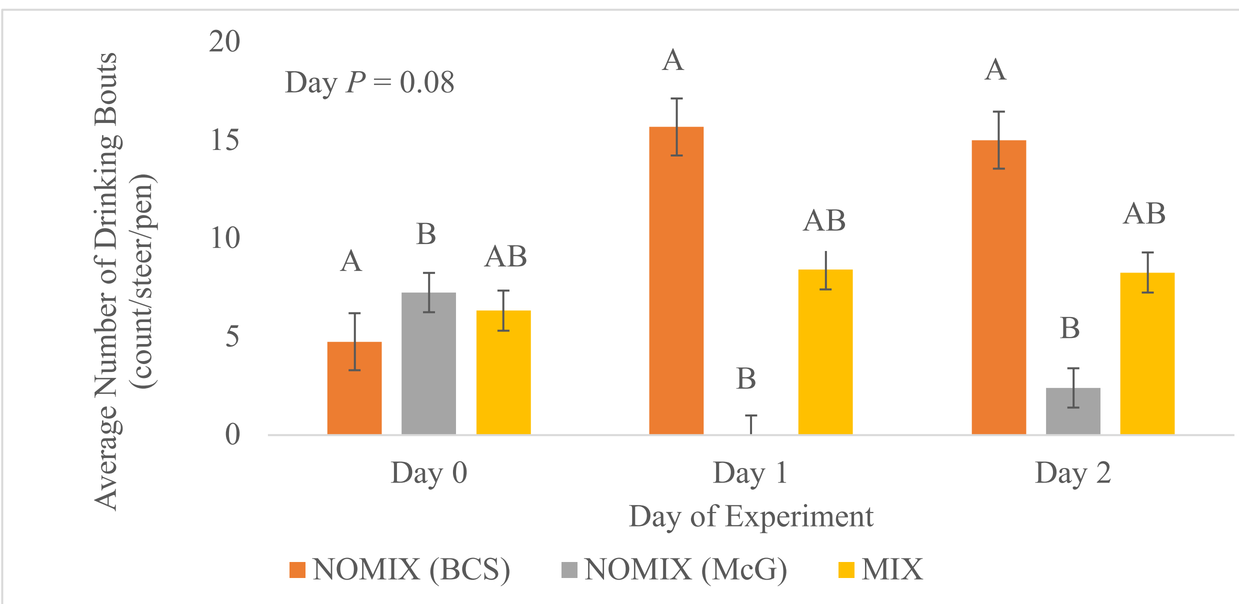
CHAPTER III

RESULTS

Drinking Behavior

NOMIX steers tended to perform more drinking bouts (10.54 ± 1.27) than MIX cattle (7.68 ± 1.05; $P = 0.08$) (Figure 1B). NOMIX steers differed in their drinking behavior based upon source. BCS steers performed the fewest drinking bouts on d 0 (4.75 ± 2.22), while they performed the most drinking bouts on d 1 (15.67 ± 2.56) and d 2 (15.00 ± 2.22) (Figure 1A). McG had the most drinking bouts on d 0 (7.25 ± 2.22), while they had the least on d 1 (0 ± 0) and d 2 (2.40 ± 2.80) (Figure 1A).

A.



B.

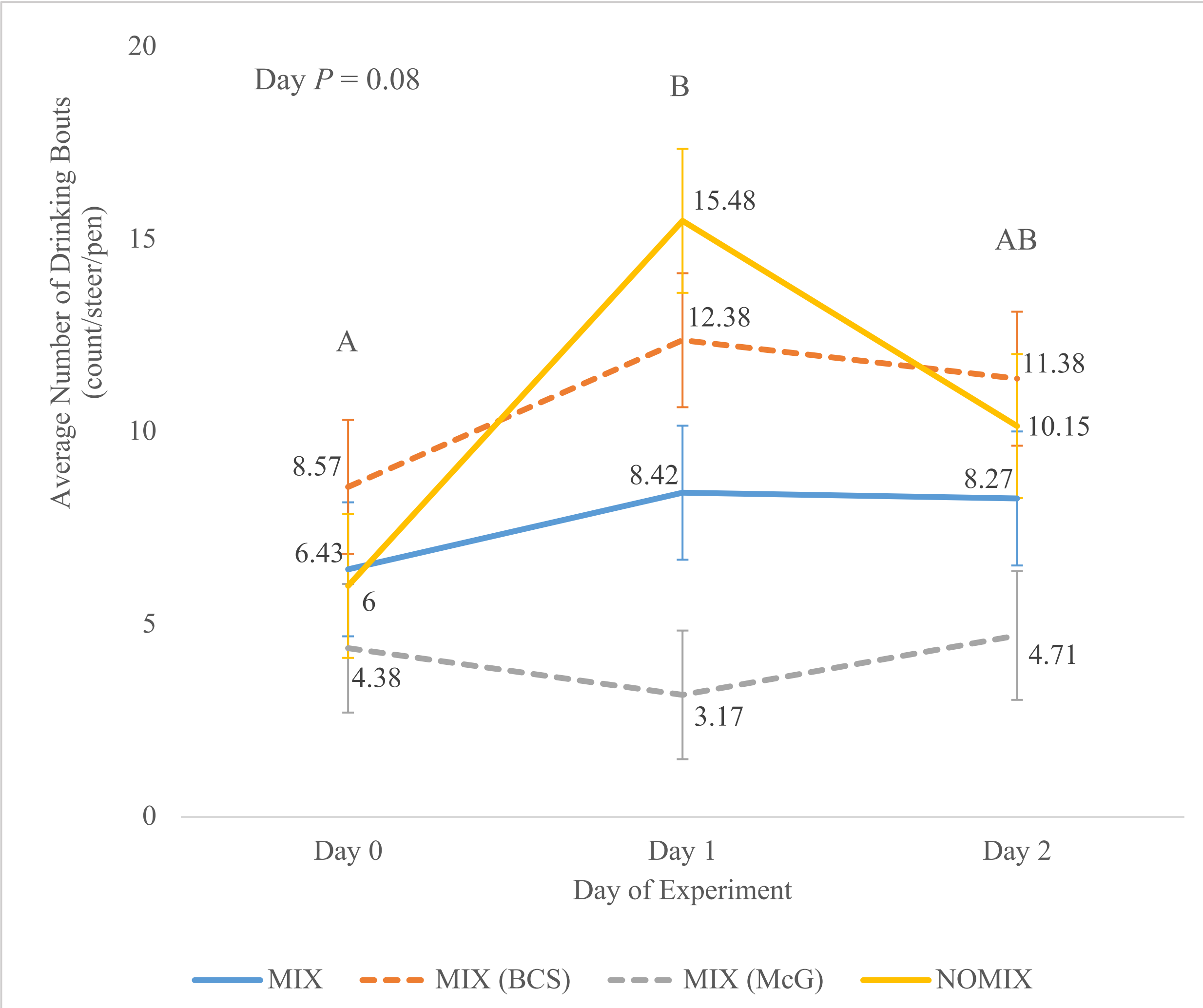


Figure 1: Average number of drinking bouts per day for animals in MIX and NOMIX pens, with (A) NOMIX pens broken out by source and (B) MIX pens broken out by source.
[A,B] Within a day, treatments lacking common letters differ.

NOMIX cattle performed more drinking bouts than MIX steers. However, within the NOMIX treatment there were differences between the two sources. While BCS steers had fewer drinking bouts/steer/pen on d 0 (4.75 ± 2.22), they performed more drinking bouts than McG steers on d 1 (15.52 ± 2.56) and d 2 (15.00 ± 2.22) (Figure 1A). Conversely, McG steers performed more drinking bouts/steer/pen on d 0 (7.25 ± 2.22), but less drinking bouts than BCS on d 1 (0 ± 0) and d 2 (2.40 ± 2.80) (Figure 1A). Thus, drinking behavior is influenced by social mixing and varies by source.

Rumination Behavior

The average time spent ruminating per day per steer for all treatments is 8.33± 0.29 h. Day impacted the time steers spent ruminating ($P < 0.001$). Steers spent the least amount of time ruminating on d 3 (8.01± 0.21) than d 1 (8.38 ± 0.21; $P = 0.03$) or d 2 (8.62 ± 0.21; $P = 0.0003$) (Figure 2). While social mixing treatment did not impact the duration of time steers spent ruminating ($P = 0.61$), NOMIX steers ruminated approximately 0.3 h (i.e., 18 min) less than MIX steers on d 1 and d 2. However, this difference dissipated on d 3 when NOMIX steers ruminated for 0.09 h (i.e., 5 min) more than MIX steers. When the two sources within NOMIX treatment group were compared against each other, steers originating from BCS ruminated for approximately 1.5 h more per day (8.91 ± 0.35) than McG steers (7.58 ± 0.35; $P = 0.008$) and daily differences in mean time spent ruminating ranged from 0.74 h on d 2 to 1.71 h on d 3 (Figure 3).

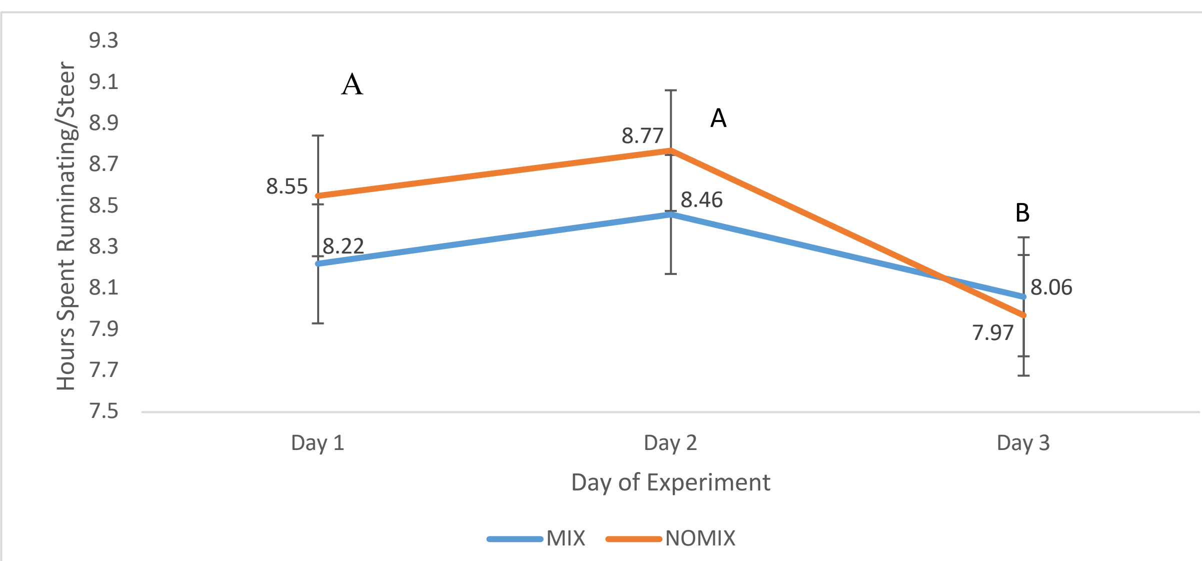


Figure 2: Average number of hours (Mean ± SEM) per day steers spent ruminating per pen for each treatment.

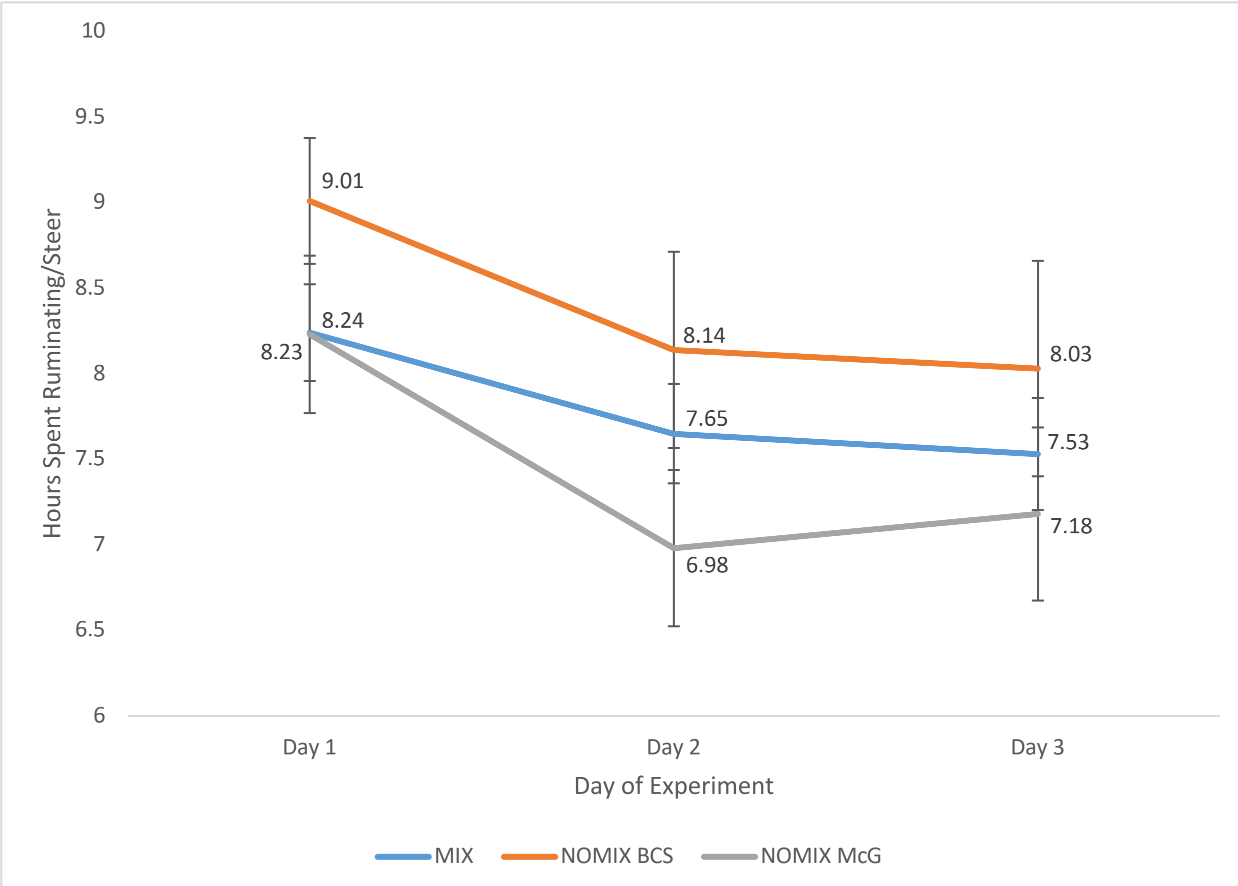


Figure 3: Average number of hours (Mean ± SEM) spent ruminating per day for animals in MIX and NOMIX pens, with NOMIX pens broken out by source.

Agonistic Behavior

NOMIX steers initiated more agonistic behaviors (5.83 ± 0.29) than MIX steers (4.65 ± 0.38; $P = 0.01$) overall (Figure 4). Across all treatments, steers performed more agonistic behaviors on d 2 (6.08 ± 0.44) than Day 1 (4.67 ± 0.40; $P = 0.02$) and tended to perform more agonistic behavior than d 0 (4.99 ± 0.40; $P = 0.07$) (Figure 4).

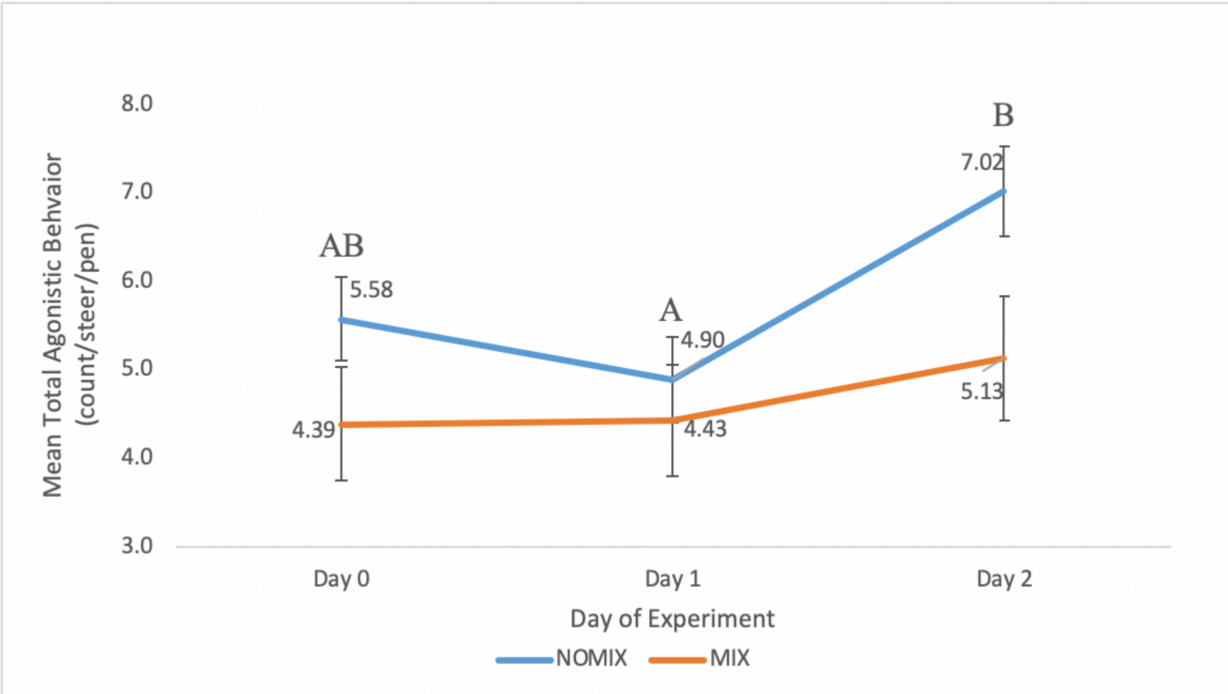


Figure 4: The average amount of agonistic behavior - including total headbutts, total mounts, and total displacements - per treatment per day.
[A,B] Within a day, treatments lacking common letters differ.

An interaction between treatment and day was observed to impact the number of mounts (P = 0.02) (Figure 5). NOMIX steers performed more mounts on d 2 (1.07 ± 0.11) than MIX steers (0.40 ± 0.16; P = 0.0009) (Figure 5). Day tended to impact the number of headbutts steers performed (P = 0.08) (Figure 6). Steers also performed more headbutts on d 2 (3.97 ± 0.34) than d 1 (3.03 ± 0.31; P = 0.0402) (Figure 6).

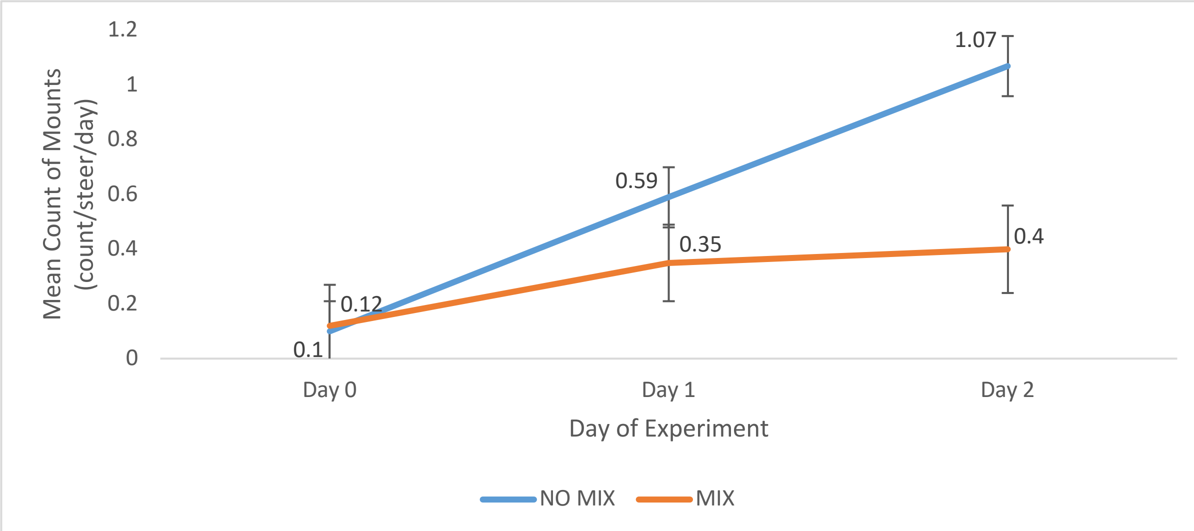


Figure 5: Average counts of mounts (Mean ± SEM) per pen for each treatment on d 0, 1, and 2.

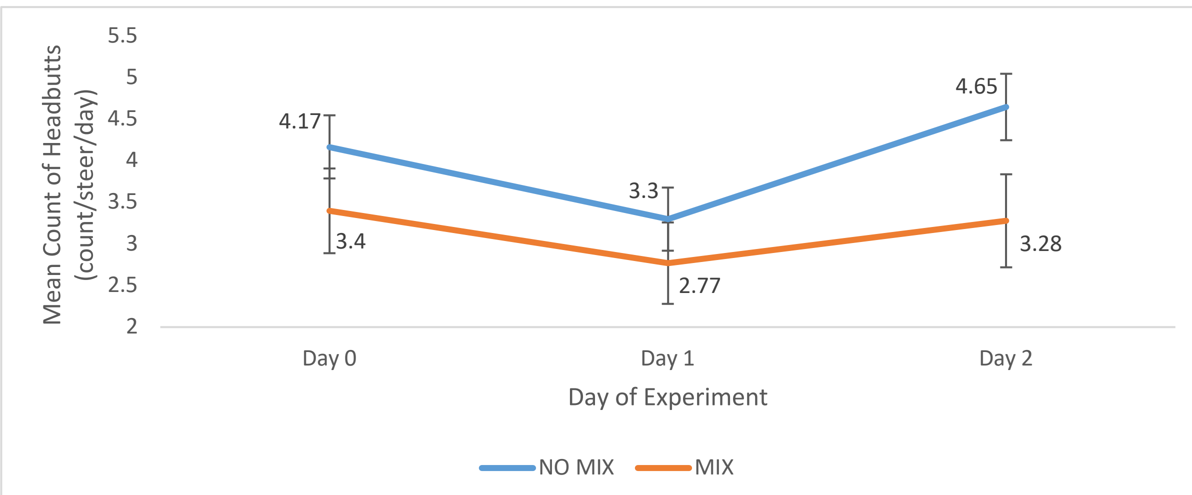
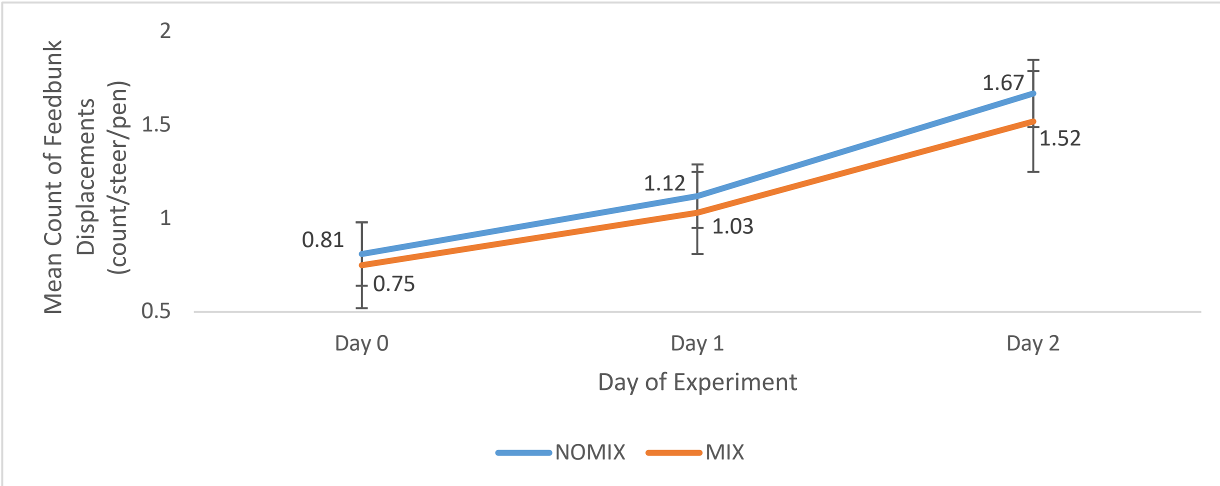


Figure 6: Average counts of headbutts (Mean ± SEM) per pen for each treatment on d 0, 1, and 2.

Day also impacted the number of feedbunk displacements performed by steers (P = 0.0008) (Figure 7A). Steers performed more feedbunk displacements on d 2 (1.60 ± 0.16) than d 0 (0.78 ± 0.15; P = 0.0002) or d 1 (1.08 ± 0.14; P = 0.0147) (Figure 7A). An interaction between treatment and day also tended to impact the number of waterer displacements (P = 0.07) (Figure 7B). NOMIX steers performed more waterer displacements (0.42 ± 0.08) on d 0 than MIX steers (0.14 ± 0.11; P = 0.04) (Figure 7B).

A.



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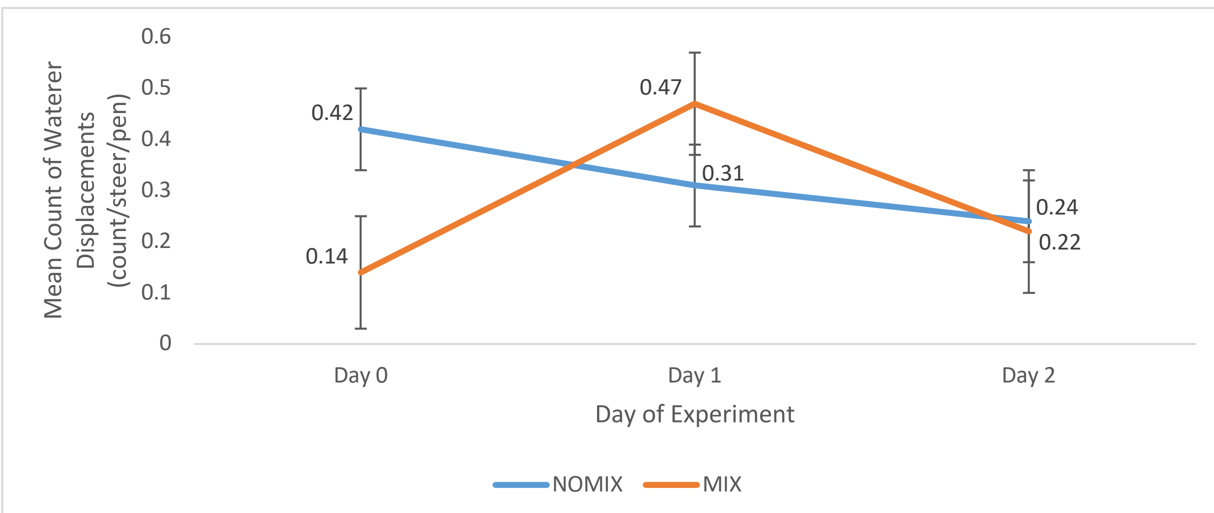

Figure 7: Average counts of (A) feedbunk displacements (Mean ± SEM) and (B) waterer displacements per pen for each treatment on d 0, 1, and 2. A.

Comparison

Drinking had weak correlation values with other behaviors that were compared (Figure 8). As drinking bouts increased, the number of feedbunk displacements initiated (R^2 = 0.23, *P* = 0.0006) and received (R^2 = 0.16, *P* = 0.02), and the number of water displacements initiated (R^2 = 0.13, *P* = 0.05) and received (R^2 = 0.25, *P* = 0.002) by all steers increased (Figure 8). Total displacements initiated ($R^2 = 0.25$, $P = 0.002$) and received ($R^2 = 0.24$, $P = 0.003$) increased with increases in number of drinking bouts (Figure 8). A correlation between dominance at the feedbunk and the water trough could be indicated. The time steers spent ruminating had very low significant positive correlations with several social behavior measures (Figure 8). As time spent ruminating increased, the number of allogrooming bouts when a steer was the recipient ($R^2 = 0.17$, $P = 0.01$), and the number of feedbunk displacements initiated ($R^2 = 0.14$, $P = 0.03$) and received ($R^2 = 0.18$, $P = 0.006$) by steers all increased. However, time spent ruminating was also tended to have a very low negative relationship with the number of headbutts received by a steer ($R^2 = -0.13$, $P = 0.06$) (Figure 8). Thus, as time spent ruminating increased a steer would tend to receive fewer headbutts.

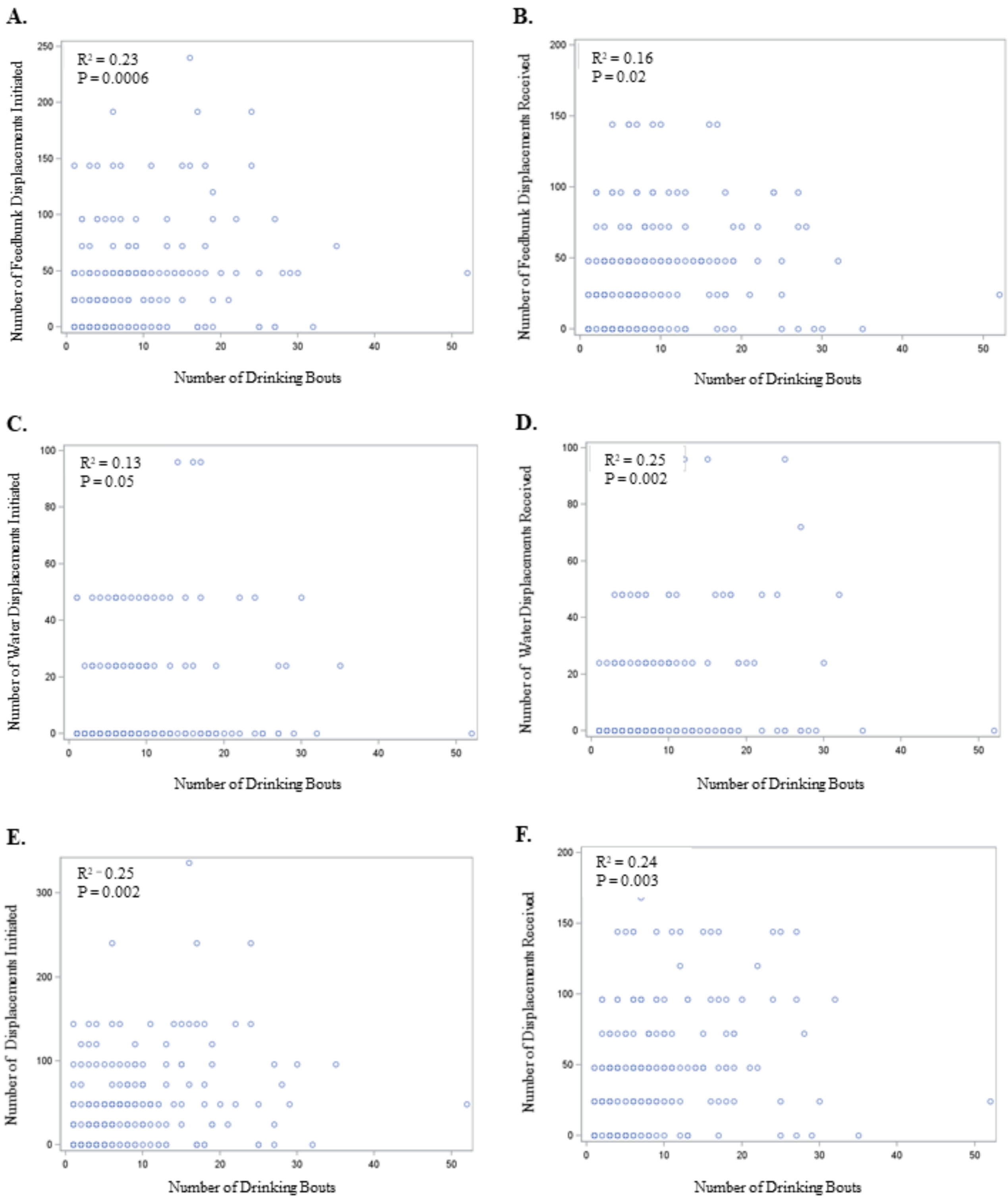

Figure 8: Drinking bout correlation with feed bunk displacements initiated (A) and received (B), water displacements initiated (C) and received (D), and displacements initiated (E) and received (F) with R^2 and *P*-value.

The time steers spent ruminating had very weak positive correlations with several social behavior measures (Table 2). As the duration of time spent ruminating increased, the number of feedbunk displacements initiated ($R^2 = 0.14$, $P = 0.03$) and received ($R^2 = 0.18$, $P = 0.006$) by steers all increased. However, time spent ruminating was also tended to have a very weak negative relationship with the number of headbutts received by a steer ($R^2 = -0.13$, $P = 0.06$) (Table 2). Thus, as time spent ruminating increased a steer would tend to receive fewer headbutts.

Table 2: Pearson correlation (n = 12) values for minutes spent ruminating (minutes/animal) for all treatments, with R^2 and *P*-value for allogrooming, feedbunk displacement, and headbutts.

Variable	**R^2**	***P*-Value**
Recipient -Allogrooming	0.17333	0.0098
Actor - Feed Bunk Displacement	0.14536	0.0308
Recipient -Feed Bunk Displacement	0.18287	0.0064
Recipient – Total Headbutts	-0.1276	0.0582
Recipient – Total Displacements	0.15113	0.0246

CHAPTER IV

DISCUSSION

Socially mixed steers may have drank less than non-socially mixed steers, because they were less familiar with half of the individuals within their pen. This may have been a result of water being a high value source with access influenced by social status, and in mixed treatments, establishment of social stability was delayed. There were differences across days with the greatest amount of drinking bouts being performed on the day after mixing. This is likely a rebound effect of less drinking of d 0 (the day of mixing) due to handling and the social instability that was greatest, which resulted in more drinking observed on d 1 (Thompson et al., 2019). There was no consistent upward or downward trend; however, limitations exist in determining the long-term effects of social instability in relation to drinking behavior with this specific dataset, and further conclusions will be drawn after future data collection is complete. These data indicate that non-mixed cattle drink more than mixed cattle.

Differences in drinking behavior between BCS and McG steers might be a result of temperament and previous experience. While each set of steers were similar genetically and age and had been weaned and backgrounded following the same protocol, there were differences between the two locations in daily animal management styles. Steers from BCS were housed in dry-lot pens in very close proximity to working facilities and pens of other cattle being used for research purposes. When any type of handling occurred at these facilities, handling was done on foot and at these facilities it was not unusual to have multiple days within a week where different groups of cattle were handled. Additionally, BCS steers and other pens of cattle were commonly fed on foot by emptying buckets of feed into a pen's feedbunk. Thus, BCS cattle were very familiar with the sight of humans on foot and may have associated humans with being fed.

In contrast, McG steers were housed in dry-lot pens on a more commercial cow-calf operation. Due to the size of the ranch and distance from the pens to the chute area, cattle on this operation are moved in very large groups via truck or all-terrain vehicle. Further, feed was delivered to the pens via a feed truck. Thus, the only time the McG steers saw humans on foot is around the chute which may have attributed to their increased flight zones and temperaments. Therefore, the increased mean number of drinking bouts after the day of mixing may be attributed to the comfort of the BCS steers within their environment. Whereas, McG steers may have been less comfortable within the feedlot environment with frequent sightings of humans on foot and increased activity (Napolitano et al., 2019). Positive and negative human interactions also play a role in environmental comfort in addition to human exposure, which may have resulted in the BCS and McG steers human comfort levels being associated with previous human interactions (Napolitano et al., 2019). Comfort of animals in their environment play a vital role in animal welfare, which can also affect their production traits, such as milking in dairy animals (Napolitano et al., 2019). Further research must be conducted to determine the correlation between animal comfort within the feedlot environment when evaluated with drinking behavior and carcass quality.

This study eliminated as many confounding variables as possible from the acclimation period to the trial period (e.g. diet change) to clearly observe the impact of social mixing on the duration of time spent ruminating. Differences across days may have been due to social mixing but could also have been impacted by weather. For example, d 3 was a very windy day in Bushland, which may account for some of the difference. While average rumination time fluctuated daily, data suggests that rumination time does not reach high or low extremes. This is likely due to the fact that rumination is a core behavior essential to survival.

Lack of moderate to strong correlations between rumination and social behaviors suggests that rumination is likely not influenced by changes in the performance of social behaviors. In contrast, other studies have found time spent ruminating to be related to day of estrus (Reith and Hoy, 2012), in addition to body size and breed (Bae and Gilman, 1983). These factors are individual specific and are all physiological, while social behaviors are not so. This may suggest that the social interactions observed in this study were not stressful enough or did not last long enough to have any measurable effect on steers' rumination times. As rumination is necessary for cattle to live, it would not be expected to easily change due to antagonistic behavior as indicated by the results.

Unexpectedly, agonistic behavior in familiar animals was greater than those observed in unfamiliar animals. There could be a possible latency period in which agonistic behavior is low upon initial mixing while the animals become familiar with their new pen mates, as some prior research suggests that agonistic behavior only increases dramatically in the hours following mixing (Bouissou et al., 2001). As the cattle become more familiar with one another, agonistic behavior could increase due to the development of a social hierarchy – which could be the reason why agonistic behavior increased from d 1 to d 2. Headbutts and mounting may have been higher for NOMIX pens because the cattle within those pens have a prior level of familiarity with one another, and therefore may have felt more comfortable to perform more overt acts of social dominance. Headbutts could also be the most convenient and easiest way to display social dominance, which is why it was the highest performed agonistic behavior. With established hierarchies in herds of cattle, in-fighting can still occur between individuals close in rank in the hierarchy and the performance of agonistic behavior is not eliminated entirely (Bouissou et al., 2001). Thus, it was expected to see agonistic behavior performed in pens of steers that were not socially mixed. However, finding that familiar steers performed more agonistic behaviors than unfamiliar steers was surprising. This may be attributed to a possibility that prior to sorting, there were individuals who hadn't had regular interactions before, as well as individuals who did, who ultimately ended up in the same pen. The mix of individuals that are very familiar with one another and individuals that could be deemed "acquaintances" may explain the increased performance of agonistic behavior.

More advanced technologies are also currently being developed in order to track animals and document behavior using video programing. This could eliminate the time-consuming task of a person decoding live video footage. Approximately one to two hours was required for one hour of video decoding. Across this study with four hours per day, three days, and 12 pens, a minimum of 288 hours of video decoding was required and more days were not evaluated due to this time constraint. Thus, utilizing only visual observation to catalog drinking behavior is very inefficient. However, if observations are used in conjunction with sensor-based technologies, such as a rumen temperature bolus, accelerometers and water flow meters, feedlot cattle drinking behavior data could be more easily collected.

While characterizing drinking behavior in cattle in feedlots is vital in better understanding animal welfare, differences between breeds and breed type must also be evaluated. Previous research has shown that *Bos indicus* and *Bos taurus* breeds differ in the amounts of water they consume, in addition to the differences seen between beef and dairy breeds (Ahlberg et al., 2019). This study was conducted utilizing Angus crossbred cattle, as such, expectations of another breed (e.g., Brahman, Nelore, Zebu) to have the same changes in drinking behavior would be erroneous. Thus, further research is necessary to quantify breed differences in the changes on drinking behavior of cattle in feedlots to better assist producers in evaluating animals' stress levels based on water intake and drinking behavior. Establishing standards in drinking behavior would allow for it to be a quantifiable behavior for producers, which allows for it to be utilized as a test for animal stress in relation to welfare. However, different standards must be utilized based on breed differences, which is why drinking behavior must be characterized in a variety of breeds.

CHAPTER V

CONCLUSION

This preliminary data has shown that the time cattle spend ruminating varies by day and potentially by source. However, while drinking behavior varies by day, social mixing reduces the number of drinking bouts cattle perform. Additionally, social mixing reduces performance of agonistic behavior which may cause unfamiliar cattle to take longer when establishing a new social hierarchy. The acute behavioral responses to social mixing suggest that social mixing reduces drinking behavior and delays social hierarchy establishment. Longitudinal observations will provide more insight into the impact social mixing has on long-term feedlot cattle welfare.

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