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Impact of different handling styles (good vs. adverse) on growth performance, behavior, and cortisol concentrations in beef cattle

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ABSTRACT

Our objective was to determine effects of aggressive handling on growth performance, behavior, and cortisol concentrations in beef calves. Crossbred calves (313 ± 4.7 kg; n = 54; 24 steers, 30 heifers) from a single herd were stratified by gender, body weight, and initial chute score, then allocated randomly to one of six pens. Each pen was randomly assigned to one of two handling treatments (good or adverse) applied on days 7, 35, 63, and 91. The objective of good treatment was to handle the calves quietly and gently to minimize stress. The objective of adverse treatment was to move the calves quickly and expose them to stimuli. Body weight, exit velocity, and chute scores (based on 5 point subjective scale) were recorded and salivary samples for cortisol were collected (4 calves/pen) on days 0, 7, 35, 63, and 91. Pen scores (5 point subjective scale) were recorded on days 12, 42, and 87. Data were analyzed statistically using a mixed model. Chute scores tended to be higher (more agitated) in the adverse treatment on day 7, but scores did not differ on subsequent days (treatment × day; $P = 0.06$). Salivary cortisol concentrations on day 63 were greater in cattle on the adverse treatment (treatment × day, $P = 0.001$). Body weight, exit velocity, and pen scores were not affected by treatment ($P \geq 0.24$). While differences were observed, these cattle appeared to acclimate to short-term adverse handling which did not seem to dramatically affect performance or behavior of beef cattle.

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MEET THE STUDENT-AUTHOR

Joan Michelle Bauer

I grew up in South Saint Louis, Missouri where I graduated from Cor Jesu Academy in 2008. Living in the city, I had access to one of the best zoological parks in the country where my love for animal science began. This led me to major in Animal Science here at the University of Arkansas. While here, I got involved with the Equine Science Department and started a minor in Equine Science my second year. Since joining, I have been in two internships at the D. E. King Barn, helped with Block and Bridle play days and a number of Horse Festivals, and volunteered whenever I have been needed. Through the Equine Science program, I was also able to travel to Scotland in the summer of 2010 for Oatridge College's Equestrian Program.

In my Sophomore year, I also joined the Honors College. This gave me the opportunity to work with my advisor and mentor, Beth Kegley, on my own research project. Coming from an urban background, it was exciting for me to get the chance to work with cattle. I have truly enjoyed learning from all those who helped me with my research and patiently taught a city girl how to move calves.

I graduated in May 2012 with honors and hope to continue my work with hoofed animals, further my education, and one day work at a zoo.

INTRODUCTION

Animal welfare has become one of the most important issues of the day. The Animal Welfare Institute states on their website that its greatest area of focus today has been what they call "cruel animal factories," or in other words livestock farms (Animal Welfare Institute, 2010). All around the world people have been demanding and working for a reform in livestock management. For years, there have been citizen petitions and legislative bills calling for better treatment of animals in the livestock industry (Centner, 2010). These issues range from where animals are held to how they are slaughtered, all with the goal of improving living conditions and reducing the animals' stress. This sort of public outcry is one reason why research in this area has become so extensive and important.

Treatment of livestock is also the concern of producers, not only to follow the guidelines of animal welfare legislation but to increase productivity. More recently stockmanship's impact on cattle behavior and the quality of product has become a point of interest in research. Does aversive handling really reduce productivity significantly? While research is relatively thin in this area there have been studies that have shown this to be true. As stated in one article, the hormone cortisol, which increases in animals that have been exposed to stressful situations such as adverse handling, has been shown to negatively impact performance in animals that have been exposed to elevated cortisol long-term, but short-term exposure does not appear to have a negative effect on health and, in fact, can boost the immune response (Burdick et al., 2009). Studies done by Hanna et al. (2006), Breuer et al. (1997), and Seabrook (1984) showed that negative handling affects the milk yield in dairy cattle, reducing it 6-13%. Likewise, a study in Australia by Petherick et al. (2009) determined that poor treatment does negatively impact live weight gain if the treatment is aversive enough.

In our study, we sought to continue the investigation in this area and determine the impact different handling styles —good vs. adverse—had on growth performance, behavior, and cortisol concentrations in growing beef cattle.

MATERIALS AND METHODS

In this study, crossbred Angus calves (n = 54; BW = 313 ± 4.7 kg; 24 steers and 30 heifers) were housed on six (2.4 hectare) mixed grass pastures. They were penned in groups of nine with the sexes mixed. Cattle were offered bermudagrass hay ad libitum and were supplemented with dried distiller's grain (0.75% body weight per day basis). Amount was adjusted monthly based on recorded body weights. Water and a mineral supplement (Powell 4% Beef Mineral, Powell Feed and Milling Co. Inc, Green Forest, Ark.) were available ad libitum.

Initial Processing. This 92-day study began on February 16, 2011 on day -15. On that day we weighed the calves, recorded chute scores, and then stratified calves by gender, body weight, and chute score to allocate them randomly to one of six pens. On day 0, cattle were weighed, given a dewormer (Dectomax, Pfizer Animal Health, New York, N.Y.), steers were implanted with Component TE-G (Ivy Animal Health, Inc., Overland Park, Kan.), chute scores were recorded, an initial salivary sample was obtained, an exit velocity was recorded, and cattle were sorted into assigned pens.

Treatments. Each pen was assigned randomly to one of two treatments (good or adverse). Calves in the good treatment groups were handled quietly with minimal stress; therefore, this treatment included moving calves from the pasture to the working facility quietly and with minimal prodding, a 15-minute rest period where they were left alone in the holding pens, gentle handling through the chute, and a quiet working facility. The goal of the adverse treatment groups was to work the calves as quickly as possible. This included moving the calves from the pasture to the holding pens as rapidly as possible, a 15-minute period where they were exposed to extraneous noises and stimuli such as recorded distressed cow noises, trains, slamming gates, banging, etc., exposure to load talking and taped sale barn noises while being worked through the chute, and aggressive prodding when they refused to move. These treatments were only applied on working days which were days 7, 35, 63, and 91. Each treatment group was worked separately; therefore, we worked the good treatment groups first, returned them to their pastures, and then brought up the adverse treatment groups to be worked.

Measurements. On working days (day 7, 35, 63, and 91) the first thing measured was labor efficiency which was done by recording two times: the time it took to collect the calves and the time it took to work them through the chute. For the first factor, we began timing when the handlers entered the pasture and stopped when the last calf exited the pasture, and for the second factor we recorded the amount of time between the first calf entering the restraining chute to the last calf exiting the restraining chute.

While in the restraining chute, we measured production by recording each calf's body weight and then determining average daily gain. While in the handling facility, a chute score was recorded to measure temperament. Each calf's chute score was recorded by two people independently and was based on a subjective 5 point scale (1 = calm, 2 = restless shifting, 3 = constant shifting with occasional shaking of weight box, 4 = continuous vigorous movement and shaking of weight box, and 5 = rearing, twisting, or violently struggling). An exit velocity was also recorded upon the calves exiting the restraining chute. Two electric beams were placed 1.5 meters and 3.7 meters from the front of the chute. The electric beams recorded the time it took each calf to traverse 2.2 meters.

To measure cortisol concentrations, saliva samples from four pre-selected calves per pen were collected while cattle were in the restraining chute. The saliva samples were collected using a sponge held by a surgical clamp and inserted into the cheek. The sponge was then compressed with a syringe into a vial to collect approximately 2 ml of sample. Samples were then sealed and frozen at -20 °C until analysis. Salivary cortisol samples were analyzed using the Salimetrics' Salivary Cortisol ELISA test (State College, Pa.).

On days 12, 42, and 87, another temperament score was taken using subjective pen scores. These were recorded by an evaluator who scored three pre-selected calves per pen —marked by blue ear tags—upon initial approach in pasture and a second approach following a period of 5 minutes in the calves' presence. Pen scores were based on a 5 point scale (1 = unalarmed when approached, 2 = slightly alarmed and trots away, 3 = moderately alarmed and moves away quickly, 4 = very alarmed and runs off or charges, 5 = very excited and aggressive towards evaluator).

All data were statistically analyzed using a mixed model through SAS (SAS Institute Inc, Cary, N.C.) where fixed effects were treatment, sex, day when appropriate, and all interactions. Random effect was replication, and the subject was pen.

RESULTS AND DISCUSSION

A tendency for a treatment × day interaction (Fig. 1, $P = 0.08$) was observed for time to gather cattle from the pasture. The good treatment groups were significantly faster on day 7, and slower on day 35. Times did not differ on days 63 and 91. A similar switching pattern was observed for the time it took to work the cattle through the handling system; however, there was a significant treatment × day interaction (Fig. 2, $P = 0.02$). The adverse groups were faster on days 7, 35, and 63, but the good groups were faster on day 91. The inconsistencies in these results could be due to many outside factors such as the calves distance from the gate, to weather, to handlers' work pace that day. Such factors should be explored or eliminated in further research.

Chute scores had a tendency for a treatment × day interaction (Fig. 3, $P = 0.06$). As would be expected, there was no difference between the two groups on day 0 since there was no treatment applied on that day, but on day 7, the first day on treatment, the adverse groups were higher in their chute scores than the good groups meaning they acted out more. However, on subsequent treatment days (days 35, 63, and 91) there again was little to no difference between the two groups suggesting the calves acclimated to the treatment. There was a significant sex effect ($P = 0.01$); steers had higher chute scores than heifers (data not shown).

Salivary cortisol concentrations were affected by a treatment × day interaction (Fig. 4, $P < 0.001$). We had no cortisol concentration difference between the two groups on d 0 when treatment was not applied, but we did observe the adverse group was numerically higher on days 7, 35 and 91 and significantly greater on day 63, indicating this stress hormone can be elevated in poorly treated cattle. There was a significant sex effect ($P = 0.02$) with heifers exhibiting greater salivary cortisol concentrations (data not shown).

A treatment × sex interaction (Fig. 5, $P = 0.01$) was observed for pen scores. The heifers in the good treatment groups exhibited a greater alarm response to the evaluator than did the heifers in the adverse handling groups; however, there was no difference in pen scores among the steers. This pattern was maintained in the 5-minute evaluation as well (Fig. 6, $P = 0.03$).

There were no treatment effects on either exit velocity (Fig. 7, $P = 0.44$) or body weight (Fig. 8, $P = 0.65$). The lack of treatment effect on production is consistent with findings in Petherick et al. (2009). They found their poor handling (similar to ours) had only a temporary effect on liveweight gain. The concern among Petherick et al. (2009), as well as Hanna et al. (2006), was that handling methods used in their experiments were not extreme enough to produce the same results as previous studies. Based on the results for chute score, exit velocity, and cortisol concentrations, it appears the adverse handling in this study was not sufficient enough to produce a number of significant responses as seen in previous studies. These results are also consistent with the findings stated by Burdick et al. (2009) that such short-term exposure (acute stress) to elevated cortisol levels does not have an effect on health; whereas, a more prolonged exposure (chronic stress) would negatively impact productivity. Another concern among Hanna et al. (2006) and Petherick et al. (2009) was the predictability of the handlers' treatment. As the chute scores show, the calves became acclimated to our adverse treatment. Similar patterns were observed in Petherick et al. (2009), indicating that the cattle began to anticipate the patterns of the poor handling and thus reduce its aversiveness. Hanna et al. (2006) discussed the effects of unpredictable handler behaviors on the milk yields of dairy cows and the need for further research into the effect of different kinds of handler behaviors.

CONCLUSIONS

Results from the calves' chute scores indicate that cattle can become acclimated to repeated events. However, adverse treatment can elevate cortisol concentrations, an indicator of stress levels, in calves. Due to the lack of treatment effect on body weight, we conclude that this particular adverse treatment did not affect production in growing beef calves which is consistent with previous findings that short-term exposure has little to no effect on calves. Possibilities for further research would be to test the effects of long-term exposure and different types of handler behavior on cattle production.

ACKNOWLEDGEMENTS

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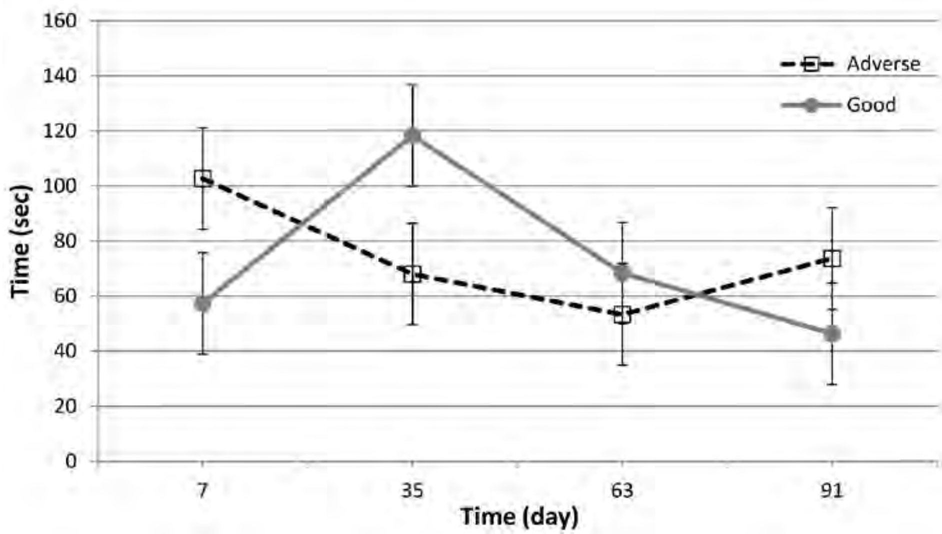

Fig. 1. The average time for each treatment group for handlers to collect the cattle and move them out of the pasture on each treatment day. Error bars indicate standard error of the least squares mean. Treatment × Day $P = 0.08$.

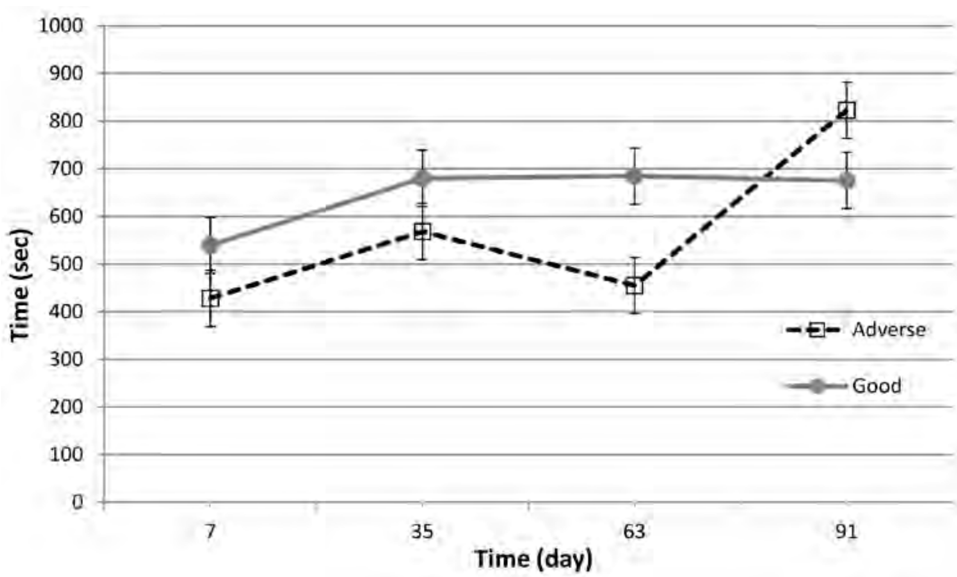

Fig. 2. The average time for each treatment group to be worked through the chute on each treatment day. Error bars indicate standard error of the least squares mean. Treatment × Day $P = 0.02$.

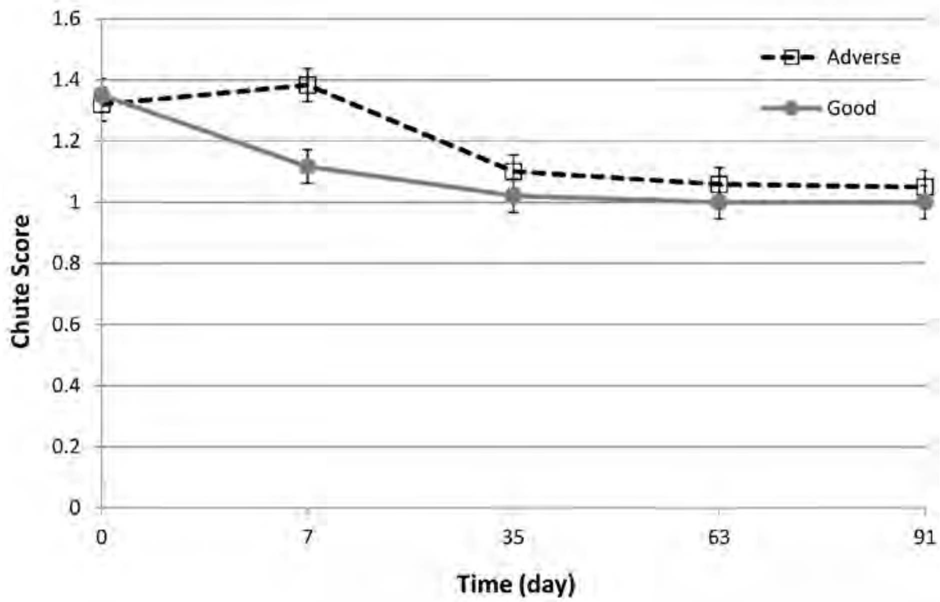

Fig. 3. Average chute score for each treatment group on days of treatment. Error bars indicate standard error of the least squares mean. Treatment × Day $P = 0.06$.

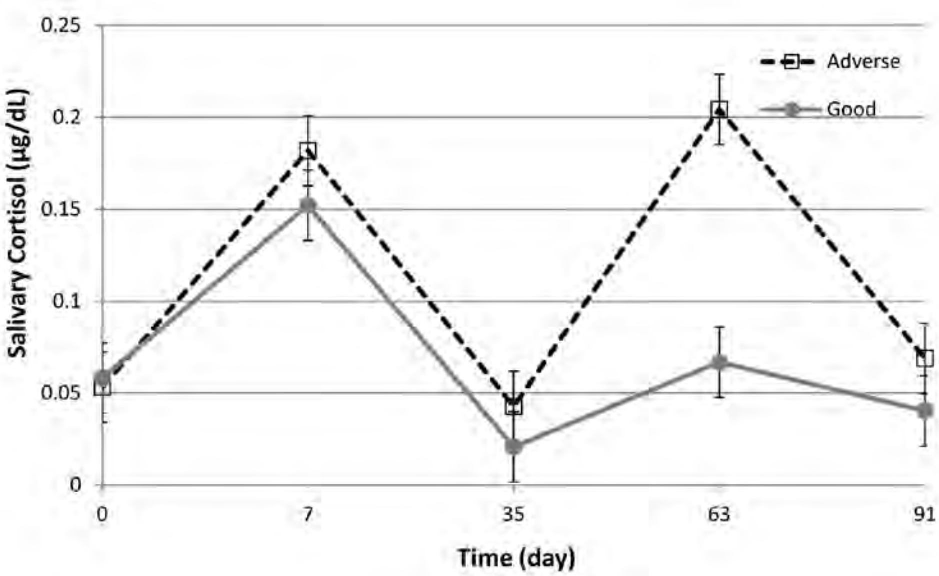

Fig. 4. Average cortisol concentration for each treatment group on days of treatment. Error bars indicate standard error of the least squares mean. Treatment × Day $P < 0.001$.

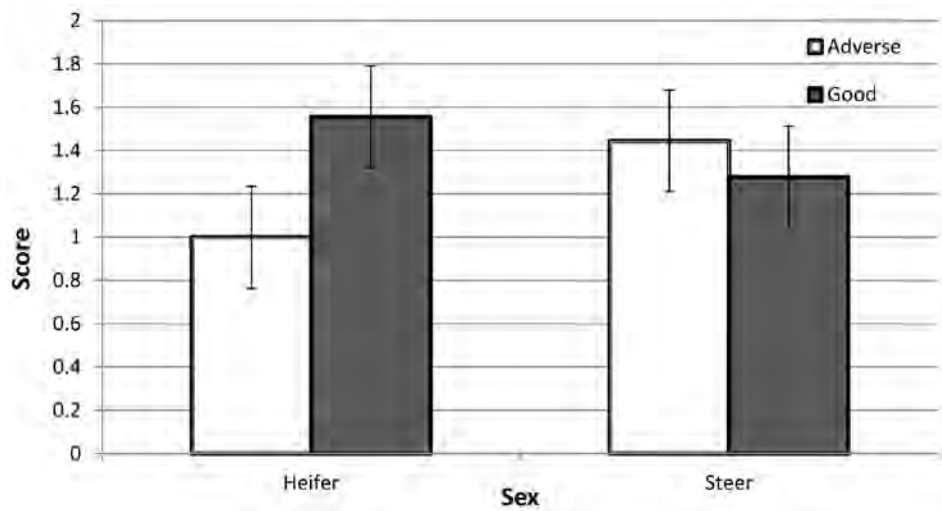

Fig. 5. The total average initial pen score for each sex in each treatment group. Pen score is an indicator of reaction of each pre-selected calf upon the approach of an evaluator (higher score = more alarmed). Error bars indicate standard error of the least squares mean. Treatment × Sex *P* = 0.01.

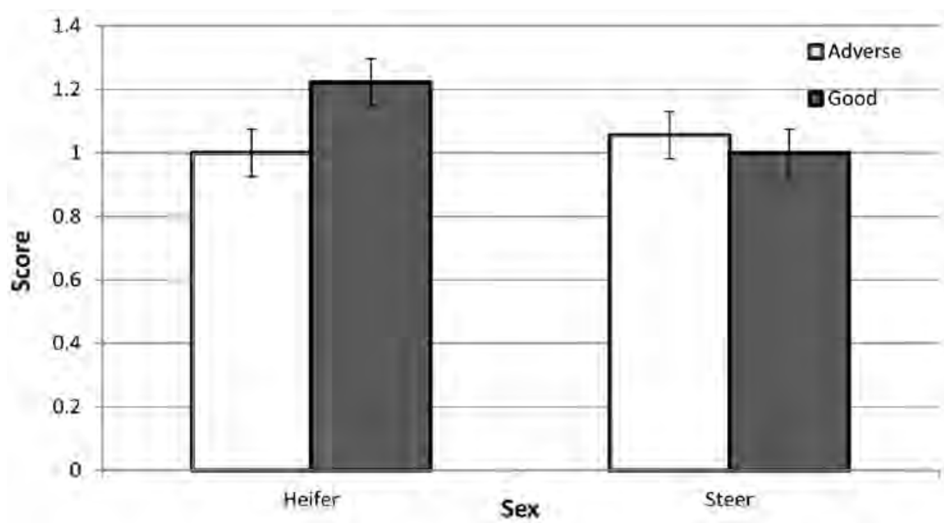

Fig. 6. The total average 5-minute pen score for each sex in each treatment group. Pen score is an indicator of reaction of each pre-selected calf upon the approach of an evaluator (higher score = more alarmed). Error bars indicate standard error of the least squares mean. Treatment × Sex *P* = 0.03.

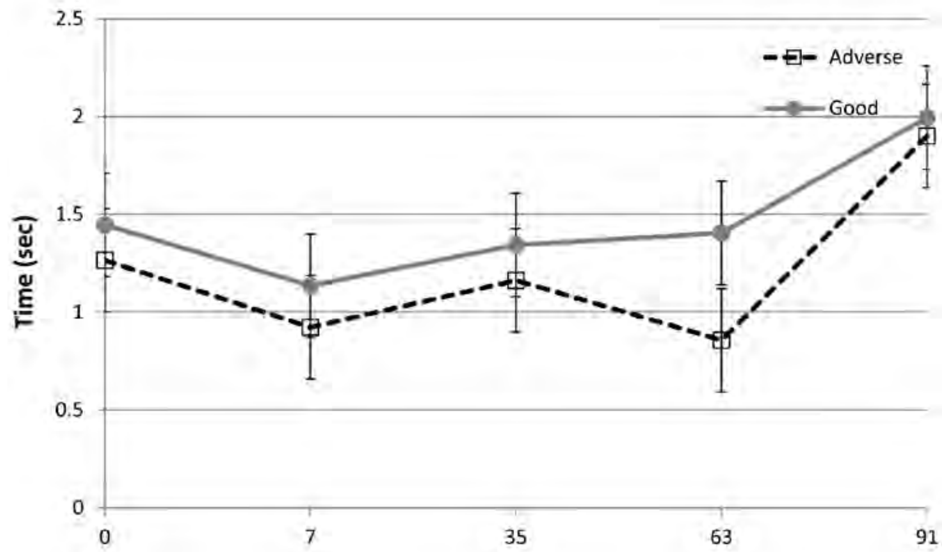

Fig. 7. Average time for each treatment group to exit the chute on days of treatment. Electric beams were placed 2.1 meters apart in front of the chute. Error bars indicate standard error of the least squares mean. No treatment effect. *P* = 0.44.

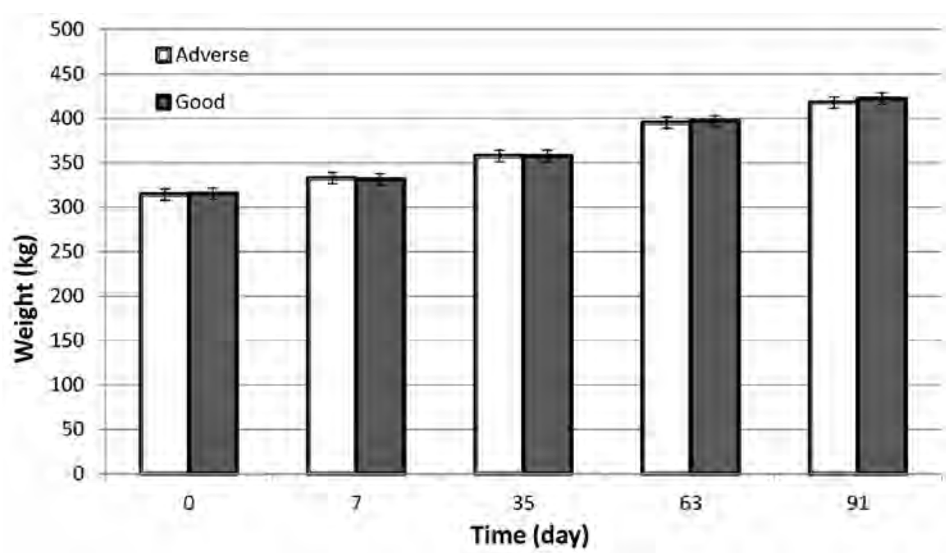

Fig. 8. The average weight of each treatment group as weighed on each treatment day. Error bars indicate standard error of the least squares mean. No treatment effect. *P* = 0.65.