Animal Welfare

1: EXAMINATION OF A CAPTIVE BOLT STUNNER WITH THREE DIFFERENT BOLT LENGTHS ON CATTLE BRAIN DAMAGE AND SPECIFIED RISK MATERIALS DISPERSION

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Objectives: Captive bolt stunning is a standard and effective method of rendering cattle unconscious for slaughter. An unrecoverable penetrating stun is ensured by correct placement of the captive bolt stunner. The purpose of this study was to determine the effect of different bolt lengths on sustained brain damage and presence of specified risk materials (SRM) in blood of Holstein and non-Holstein cattle. It was hypothesized that brain damage and SRM dispersion would not differ based on bolt length or breed type.

Materials and Methods: The study was designed as a randomized unbalanced block design. Test day served as a block and the experimental unit was animal. Data were analyzed with SAS (SAS Inc., Cary, NC) using a paired t-test. Each collection was assigned one of three lengths; control (CON; 15.2 cm), medium (MED; 16.5 cm), or long (LON; 17.8 cm). All animals sampled were less than 30 months of age. Blood was randomly sampled immediately following the start of exsanguination from 33 animals per treatment, with an equal split of Holstein and non-Holstein breed type. Blood samples were sent to IEH-Warren Analytical Laboratory (IEH, Greeley, CO) where the Colorado State University fluorescent enzyme-linked immunosorbent assay (F-ELISA) was conducted for detection of glial proteins. For brain damage assessment, 292 heads were randomly sampled across three collection periods, with an equal split between non-Holstein and Holstein breed type. Heads were collected, chilled, and brought to the Necropsy Laboratory (Colorado State University, Veterinary Teaching Hospital, Fort Collins, CO) for splitting and damage analysis. Skulls were split with a bandsaw through the median plane of the captive bolt penetration tract. Brains were photographed and assessed for damage to the frontal lobe (FL), parietal lobe (PL), occipital lobe (OL), olfactory bulb (OB), hypothalamus (HYP), corpus callosum (CC), fornix (FOR), and the thalamus (THAL). Brain structure disruption was determined with a graphic overlay along the median plane; each structure was recorded as either damaged or non-damaged. Additionally, evidence of double knocking (DK) or skull plate fragments in the brain tissue (BC) were recorded.

Results: The Colorado State University F-ELISA found that 97% of the CON blood samples were negative, 94% of the MED blood samples were negative, and 100% of the LON blood samples were negative. The level of brain damage did not differ between breed type for any structure measured ($P = 0.607$). The amount of brain damage was statistically different between CON and LON for FL, OL, and THAL ($P = 0.004$, $P = 0.025$, and $P = 0.002$, respectively). The FL, OL, CC, and THAL differed between MED and LON ($P = 0.022$, $P = 0.043$, $P = 0.043$, and $P = 0.002$, respectively). Comparisons between CON and MED showed that only FL damage differed ($P = 0.033$). The percentage of DK and BC in brain tissue did not differ based on treatment or breed type ($P = 0.399$, $P = 0.311$). The brainstem was not disrupted for any of the treatments.

Conclusion: There was sufficient evidence that differing bolt lengths affect the amount of brain damage to the skull and brain structures. Additionally, there was minimal evidence to support that changes in SRM dispersal occurred due to bolt length. Further work is required to determine how bolt length could affect SRM transmission in older animals.

Keywords: Beef, Brain Damage, Captive Bolt

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2: THE EFFECTS OF STOCKING DENSITY ON ANTIBIOTIC FREE BROILER FLOCK PERFORMANCE AND YIELD

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Objectives: Maintaining optimal litter conditions is essential to minimizing disease in broiler houses. Ultimately, flux in welfare standards will alter management practices. Antibiotic-free (AF) broilers raise concerns regarding flock health, because of the limitations regarding disease treatment. In the study, we evaluated flock performance parameters and yield of AF broilers as it relates to stocking density.

Materials and Methods: Commercially available rapidly growing broilers were raised at a high stocking density (697 cm^2 per bird) and a low stocking density (836 cm^2 per bird). Four flocks, each with 19,740 straight run broilers, were housed in an industry standard facility located at California State University, Fresno. The broiler production barn was subdivided into four equal-sized pens, which run the length of the barn. These pens served as alternating stocking density treatments during each flock. Body weight, litter moisture, percent mortality, and coccidiosis in litter were measured every week for six weeks, while feed conversion was measured at the end of the flock. Body weight, litter moisture, percent mortality, and coccidiosis counts in litter were analyzed using Student's t-tests. At the processing facility carcass weights were obtained and yield was calculated. Yield data was analyzed using the ANOVA procedure of SAS.

Results: No significant differences were detected in body weight between stocking densities or in weekly percent mortality. As expected, litter moisture was greatest in high-stocking densities in weeks 1, 2, 3, 4, and 6. Yet, there were no statistical differences in coccidiosis counts in the litter. Feed conversion efficiency was less ($p < 0.05$) in birds reared at the high- than low-stocking density (1.66 ± 0.06 vs 1.81 ± 0.04), but birds reared at the low-stocking density tended to have greater ($p = 0.07$) carcass yields than those reared at the high-stocking density (68 vs 66%).

Conclusion: The results confirm that lower stocking densities equate to a lower litter moisture, which reduces the potential of disease spread. However, no differences in coccidiosis counts in the litter. Interestingly, the increase in feed conversion present in low stocking densities represents an increase in feed costs.

Keywords: Antibiotic free, broilers, stocking density

Animal Welfare

3: OBSERVATIONS OF PEN STOCKING CAPACITIES FOR OVERNIGHT LAIRAGE OF FED CATTLE AT HARVEST FACILITY

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Objectives: Fed cattle slaughter facilities often have cattle delivered to the facility with the intention to hold the cattle overnight. As required by USDA FSIS, cattle that are held overnight at the harvest facility are required to have lying space in pens. The current guideline in industry is 1.86 m^2 per animal at an estimated live weight of 544.31 kg. However, cattle weights have increased over time while the space to lie down has remained constant.

Materials and Methods: This field observation was designed to determine if 1.86 m^2 is enough space for a *Bos taurus* steer or heifer, with no *Bos indicus* or Holstein influence, to lie down, with an assumed live weight of 544.31 kg. This field observation evaluated space requirements for cattle that varied in average weight from 521.63 kg to 717.13 kg. It was hypothesized that the pen space requirements would not differ based on average live weight of the cattle. This field observation utilized a random incomplete design over a five day period. Pens were selected for adequate lighting, distance away unloading docks, and distance away from entrance to the harvest facility. The pen dimensions were measured before daily production began and average weights of the cattle were obtained from the harvest facility scale house. Once the selected overnight pens were filled with a mixture of British and continental bred cattle, cameras were placed on the catwalk to capture video and photographs of the cattle lying down between 0200 h and 0400 h each day. Video and photographs were taken with a remote control so that the cattle were not disturbed by individuals on the catwalk.

Results: In this field observation, 1,584 cattle were observed and it was determined that as the weight of the cattle increased the space allocation needed to be increased to have enough space for all cattle to lie down. The space allocations estimated were a 544.31 kg animal required 1.86 m^2 per animal, a 589.67 kg animal required 1.95 m^2 per animal, a 635.03 kg animal required 2.04 m^2 per animal, and a 680.39 kg animal required 2.14 m^2 per animal. Space requirements did differ as average weight of the cattle increased.

Conclusion: Further observations are needed to fully determine the effect that average live weight has on pen space requirements of cattle at slaughter facilities.

Keywords: Cattle, Lairage, Pen Capacity, Slaughter, Weight