Methods Validated in a Research Setting including Modifications for Producers to Measure On-Farm Commercial Broiler Welfare

A.S. Leaflet R3326

Meaghan Meyer, Graduate Research Assistant,
Anna Johnson, Professor,
Elizabeth Bobeck, Assistant Professor,
Department of Animal Science, Iowa State University

Summary and Implications

Several broiler chicken behavior and welfare measures adapted from the National Chicken Council (NCC) animal welfare guidelines and audit checklist were tested on-farm for ease of use and applicability to commercial broiler producers. Broiler welfare has become an increasing concern to consumers and meat-producing companies, with more and more companies and restaurants pledging to improve broiler bird housing and well-being. Thus, the need for improved, science-based welfare audits is on the rise. Six hundred Ross 308 broilers, with a subset exposed to environmental enrichment, were used as an example flock to test welfare measures. Data associated with treatment outcomes are purposefully omitted in order to present a purely methodological report that may be used as a resource to poultry producers on-farm. Successful adaptations or novel additions to the audit guidelines validated in a research setting are recommended to producers with modifications to suit a commercial environment.

Introduction

Each meat-producing industry in the U.S. creates and audits their animal welfare expectations. Commercial broilers may be exposed to diminished air and litter quality that can result in breast blisters, footpad dermatitis, and leg lameness during their growth period. To help producers identify and address welfare challenges on farm, the National Chicken Council (NCC) Animal Welfare Guidelines and Audit Checklist for Broilers are followed by 95% of broiler producers in the U.S. These guidelines cover personnel training, hatchery operations, grow-out operations (including corporate commitment, management, training, and emergency plan, nutrition and feeding, comfort and shelter, health care and monitoring, and flock husbandry), catching and transportation, processing operations, and abuse and audit failures. Animal-based measures are generally recommended on 100 birds/flock within one week of slaughter. These guidelines are updated every two years to allow for advances in research and science-based animal welfare literature. Therefore, the objectives of this work were to validate, and to make formal recommendations of exclusion or inclusion of other animal-based welfare measures into the NCC Animal Welfare Guidelines and Audit Checklist for Broilers.

Materials and Methods

All animal procedures were overseen by the project Principle Investigator, Laboratory Animal Resources attending veterinarian, and the Iowa State University (ISU) Poultry Research and Teaching Farm manager. All protocols were approved by the Iowa State University Institutional Animal Care and Use Committee.

Animals and housing: Six-hundred straight run Ross 308 broilers were transported from a commercial hatchery the day of hatch to the ISU Poultry Research and Teaching Farm where they were housed in twenty 4 by 8 ft pens of 30 (1.07 ft^2/bird) with *ad libitum* access to hanging poultry feeders and nipple water-lines for 6 weeks. Birds were housed on fresh pine shavings. Five randomly selected "focal" birds from eight "camera" pens (four pens in each room of the barn) were wing-banded and marked with different colors of animal-safe food coloring for identification on day 0 (n = 40).

Behavioral recording: A Sony HDR-CX440 Handycam (Sony Corp. of America, New York, New York) was positioned over each camera pen. Each pen was recorded for four 4-minute periods daily at 0530, 1130, 1730 and 2330 on days 0-8 and once weekly for the remainder of the trial. Five undergraduate students were trained to score videos from all days recorded using a pre-determined ethogram for behavior or the walking distance methods (details below) to 90% agreeability by an individual with previous animal behavior experience.

Animal Based Measures:

Broiler behavior: Focal bird behavior was categorized using a pre-determined behavior ethogram for the entirety of the 4-minute clips. Bird activity was recorded as seven mutually exclusive behaviors including: inactive, active, at feeder, at drinker, preening, other, or out of camera view (Figure 1).

Walking distance: Walking distance during 4-minute periods was measured using the same video recordings/days as behavior but a different randomly selected "focal bird". The observer used a clear sheet to draw a line with a marker each time the focal broiler moved forward during the 4-minute clip, then measured and summed all "walking lines" using the custom ruler tool on Adobe Photoshop (Adobe Systems Inc, San Jose,

California). The tool was set to convert x number of pixels the bird walked (measured in a pen template image) to real-life inches, set to a standard length measured on-farm (nipple water-line).

Lameness scoring: Once weekly, all focal birds (n=40) were removed from their home pens and assessed for walking lameness using a 0-2 scoring system. Zero indicated the ability to walk 5 ft with no signs of lameness, 1 indicated a bird able to walk 5 ft but stopped or showed unevenness in gait, and 2 indicated a broiler not able to walk 5 ft. The lameness assessments were made in groups of five on week one and groups of two or three broilers on weeks 2-6 on a custom-designed walking lameness platform made of plywood. The structure was 6 ft long by 1.5 ft wide with 1 ft high walls on all sides. 5 ft of walking space was delineated and there were 6 in start and stop sections. Once placed in the starting section, birds were encouraged to walk by (1) a researcher slowly moving their hand back and forth directly behind the bird (2) a researcher gently tapping the bird on their vent region with a gloved hand or (3) a researcher waving behind or gently tapping the bird with a ping-pong paddle (Figure 2). Individual birds were considered to have completed the task when both feet had crossed into the end section.

Breast blisters and footpad dermatitis: The forty focal birds were examined for breast blisters and footpad dermatitis once per week. Breast blisters were scored present/absent; a blister was considered present when equal to or larger than 0.197 in^2, when there were one or more breast burns, or when there were scabs on the breast. Footpad dermatitis was scored pass/fail using the American Association of Avian Pathologists (AAAP) Paw Scoring system where erosions, ulcerations, scabs, hemorrhages, and/or swelling on an area greater than one half of the footpad was considered a fail (Figure 3).

Air and litter quality: Ammonia level (ppm) was measured in three separate pens (at the front, middle, and back of the barn) at bird height using a hand-held ammonia reader (GasAlert Extreme, BW Technologies, Schaumburg, Illinois) and ammonia test strips once per week. The ammonia reader was titrated weekly with an ammonia tank and provided an exact value (ppm), while the strips provide a possible range in values of 5 ppm (0-5, 5-10, etc.). Litter quality was likewise measured weekly in three different pens by gathering litter from three sections of each pen and squeezing it in the hand. According to NCC guidelines, to pass the litter must be "loosely compacted when squeezed in the hand. If the litter remains in a clump when squeezed in the hand, it is too wet".

Statistical analysis: Data in this example (not presented here) were checked for normality using PROC UNIVARIATE and analyzed using PROC GLIMMIX, a generalized linear mixed model, on SAS 9.4 due to most of the behavior data being abnormally distributed.

Results and Discussion

Broiler behavior: Using video recording to measure broiler behavior and walking distance was effective in a research setting, but would be more difficult to apply in a commercial setting. If producers are not interested in introducing video recording to their barns, we recommend simplifying methods described here for use in on-farm commercial broiler welfare audits. To measure broiler bird behavior, auditors could categorize broiler behavior using a live methodology to identify deviations from "normal" flock behavior. As broiler behavior has been observed extensively in the literature, we know that most of a broiler's daily time budget will be spent inactive, but birds should be able to rise to access feeders, drinkers, or to avoid humans walking among the flock. An audit regarding behavior is absent in the NCC guidelines, despite the value in studying behavior as a means of quantifying physical activity, feeding activity, social interactions, etc. Further work in this area is needed to determine the correct length of time and number of birds to observe, as well as exactly what behaviors would be normal/abnormal in a commercial rather than a research environment.

Walking distance: Measuring distance walked by broilers on commercial farms could be simplified by watching a randomly-selected number of birds for a set number of seconds or minutes and estimating average distance walked using a known length in the barn, such as the water line. In our research conditions, 4-minute periods were effective, but further research is needed to validate and tighten-up this time frame and bird number. It is likely that less than four minutes could be adequate in commercial audits to estimate distance traveled by individual birds. This measure proved to be successful in quantifying physical activity in a research setting using video recording, and could be replicated on-farm to quickly and easily determine broiler walking capability. Additionally, security video footage might be obtained and viewed to determine these outcomes and compare across flocks housed in the same barn. Walking distance could be used to assess flock lameness, but without encouraging the birds to walk and rather allowing them to walk of their own accord and quickly identifying lame birds.

Walking lameness: This walking lameness platform could easily be applied commercially to provide greater consistency (in flooring and environment) than gait scoring on different levels and sections of litter across a

commercial barn. Lameness is one of the biggest welfare issues commercial broilers face, and gait scores have been widely used in research and audits for years. A greater degree of lameness accuracy and quantification in a flock using a custom platform would reduce inherent observer error.

Breast blisters & footpad dermatitis: Breast blister scoring is not currently included in NCC guidelines. Breast blisters are largely caused by prolonged contact with litter that causes swelling and fluid accumulation at the keel bone, where birds place 60% of their weight when resting. The present/absent scoring system used here was simple to follow and is recommended to producers to better monitor the issue. The AAAP Paw Scoring system is also effective and is recommended to producers. However, scoring is recommended on live birds at the farm, rather than post-slaughter to monitor flock feet condition. Footpad dermatitis not only negatively impacts bird welfare, but causes an economic loss as the paws will be downgraded or rejected at slaughter.

Air & litter quality: According to NCC guidelines, ammonia levels at bird height must never exceed 25 ppm, and producers must have a monitoring and mitigation program. Both the test strips and portable ammonia reader used here were effective and simple to use, and would be strongly recommended to producers, but the reader (titrated using an ammonia tank weekly) was more accurate than the range provided by the strips. The litter quality measures recommended by NCC were also easy to use and are recommended for commercial farms to monitor areas of concern and overall litter moisture. Diminished quality of litter is associated with footpad dermatitis and breast blisters, which in turn contributes to decreased leg health and a greater incidence of lameness. Hence, monitoring and maintaining good, dry litter quality is an animal welfare priority.

Acknowledgements

The authors would like to thank the Poultry Research and Teaching Farm staff for help in animal husbandry and barn management as well as undergraduate student Julianna Jespersen for help with lameness scoring and undergraduates Maddison Wiersema, Courtney Jaeger, Kathryn Kuhl, Caitlyn Spencer, and Breanna Bagby for video analysis. Support from the Department of Animal Science, US Poultry, College of Agriculture and Life Sciences at Iowa State University, and USDA.

Figure 1. Subset of identified broiler bird home pen behavior from a video still including A) inactive, B) at feeder, C) at drinker, and D) preening. Behaviors not identified here include active, other, and out of view.

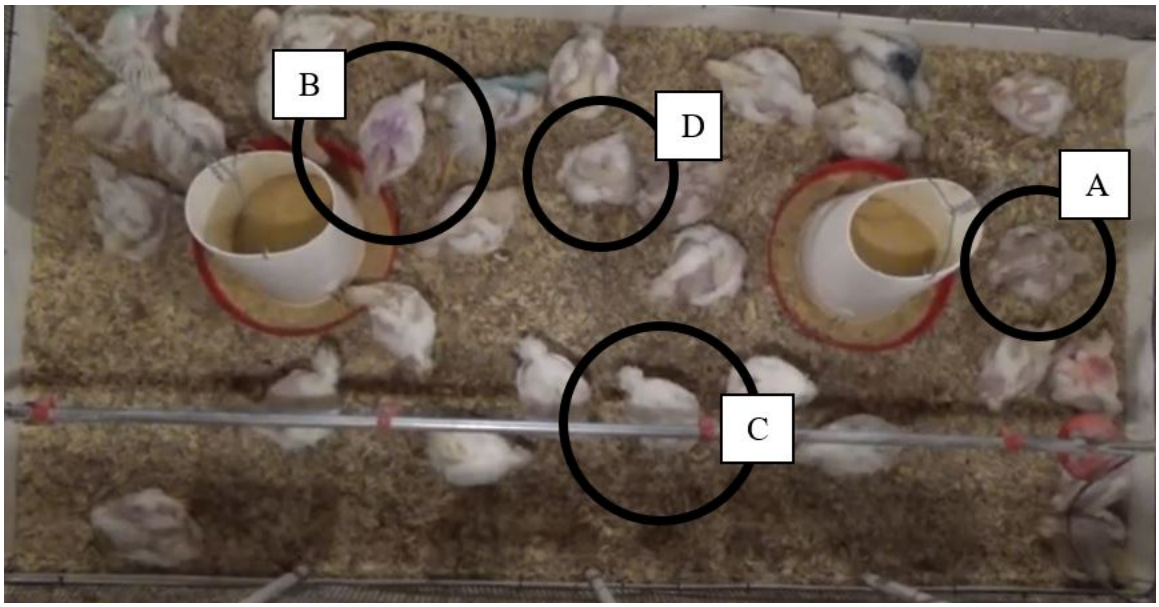


Figure 2. Five broiler chicks being scored for lameness on the custom platform during Week 1. Platform contained a 6 in start (A) and stop (B) section, along with 5 ft of walking space (C).

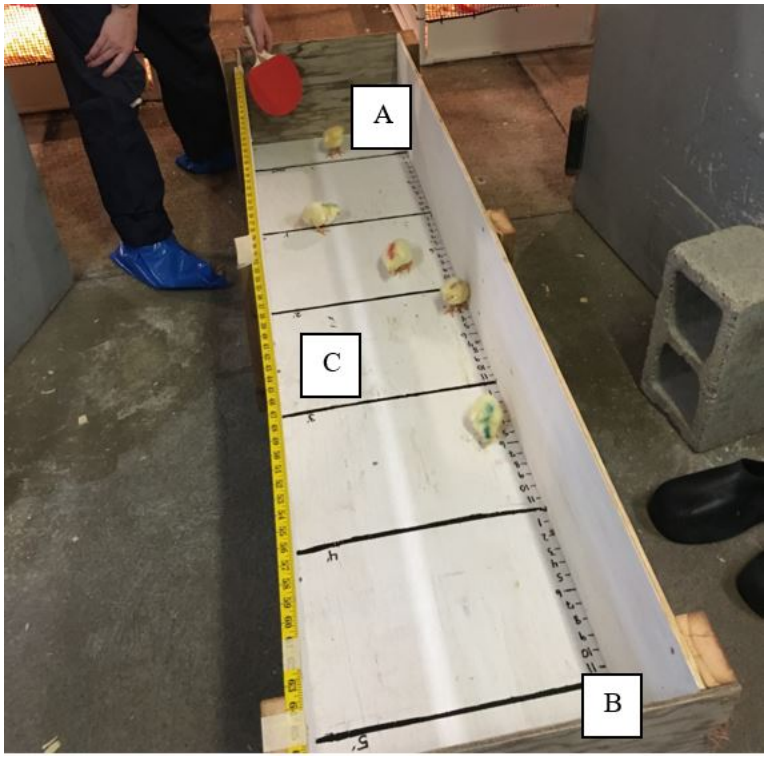
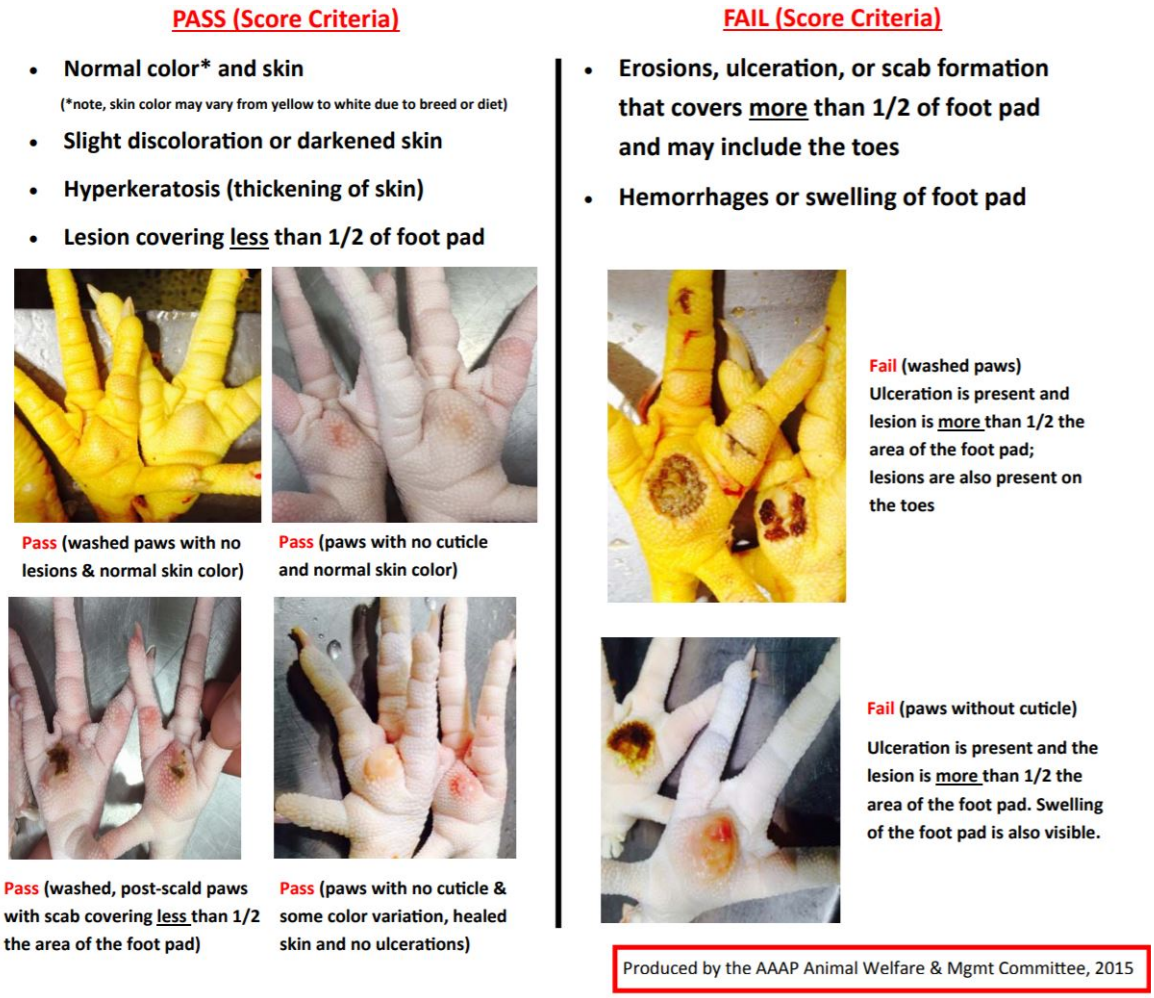


Figure 3. Adapted from American Association of Avian Pathologist's Broiler Paw Scoring Guide.



From https://www.aaap.info/animal-welfare