The Effects of Dietary Omega 3 Fatty Acids on Commercial Broiler Behavior from Hatch to Market Weight

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Summary and Implications

The objective of this experiment was to investigate how different dietary omega-3 sources affect commercial broiler behavior from hatch to market weight. One hundred and twenty male 308 Ross broiler chicks were enrolled into the study. Three dietary treatments were compared; Control, Flaxseed- and Fish-oil. Fifteen pens were randomly selected and one focal-bird was watched continually for three periods of time. One behavior, two postures, and an unknown category were collected. Week by dietary treatment interaction was not significant for any broiler behaviors ($P \geq 0.49$). There was no dietary treatment effect observed for any broiler behaviors ($P \geq 0.32$). There was no observed difference for percentage of time spent at the feeder between week 1 and 4 ($P = 0.14$). However, there was a difference for percentage of time spent active ($P < 0.0001$), inactive ($P = 0.0004$) and unknown ($P = 0.01$) between week 1 and 4. Within the context of this work, the selected omega-3 dietary sources did not affect broiler behavior between weeks 1 and 4. Independent of dietary treatment, broilers increased the percentage of time spent inactive by week 4 of the study.

Introduction

Wild Red Jungle fowl spend approximately 90% of their active time engaged in feeding activities; in contrast, commercial broiler chickens spend 76% of their day lying down. This increased inactivity in commercial broiler chickens is likely multifactorial, for example feed and water are readily available, and/or birds have a heavier body weight and/or there is an increased prevalence in skeletal deformities. Consideration has been given to the effects of dietary manipulation that may enhance broiler bird welfare. Research suggests that there are beneficial bone health effects in laying hens fed rations supplemented with omega-3 fatty acids, which in turn may alter their active behaviors during the growth period. Therefore, the objective of this experiment was to investigate how different dietary omega-3 sources affect commercial broiler behavior from hatch to market weight.

Materials and Methods

The protocol was approved by the ISU-IACUC committee. This work was conducted between December 7th, 2015 and January 4th, 2016.

Animals and identification: One hundred and twenty male 308 Ross broiler chicks were procured from a local hatchery on hatching day and transported directly to the Iowa State University Poultry Research and Teaching Unit. The back of each individual chick was colored blue, orange, green, or no color at the start of the experiment to track individual bird movement with overhead video cameras.

Housing: Chicks were acclimated for 6 days and fed a common corn-soybean meal starter ration with a calculated CP of 25.43%, ME of 3,200 kcal/kg, 1% calcium, and 0.45% available P. Four chicks were housed in a 1.2 m × 1.2 m (3.3 ft. x 3.3 ft.) pen with 10.2 cm (4m inches) depth of pine bedding. The house was heated to 29° C, (98 ºF) and reduced until 21° C (70 ºF) was attained. One supplemental lamp heat source per pen was provided from arrival to day 6. Incandescent lighting was used in the house, with approximately 1 m (3 ft.) high candles. The lighting program was 23L:1D (30 to 40 Lux) from arrival to 7 days of age, and then 20L:4D (20 to 30 Lux) for the remainder of the experiment. Feed was provided in round feeders 30.5 cm diameter × 29.2 cm high (Brower Equipment, Houghton, IA) *ad libitum* along with Ziggity waterlines and 360° nipple drinkers (Ziggity Systems Inc., Middlebury, IN), 5 nipple drinkers per pen. Waterlines were set at 2 to 5 cm of column pressure from 0 to 14 days of age, and increased to 10 cm of column pressure for the remainder of the experiment.

Experimental design and dietary treatments: At the beginning of the experiment (day 0), 6-day old chicks were weighed using an Ohaus Defender 3000 digital scale (Ohaus Corporation, Parsippany, NJ) and placed into pens (pen was the experimental unit; n=10/dietary treatment) balanced by broiler body weight (BW). The average broiler chick BW was 147.9 g (control) 149.6 g (flaxseed oil) and 149.5 g (fish oil). Three dietary treatments were compared and all diets were formulated to meet or exceed the Nutrient Requirements of Poultry guidelines (NRC; Table 1). Two phases were formulated for the experimental diets, a starter phase for weeks 1 to 3 and a grower/finisher phase for the remaining week. Diets within each phase were formulated to be isocaloric, isonitrogenous, and contain the same percentage total fat.

Table 1: Dietary treatments

Diet	Composition
Control	No supplemental ω-3 source
Flaxseed oil	4% total omega-3 using flaxseed oil (50%alpha-linolenic acid)
Fish oil	4% total omega-3 using bulk fish oil (18% eicosapentaenoic acid and 12% docosahexaenoic acid)

Behavioral acquisition: One 12 V color Close Circuit Television (CCTV) camera (Model WV-CP484, Matsushita Co Ltd, Japan) was positioned overhead. Video was captured digitally utilizing a Noldus portable lab (Noldus Information Technology, Wageningen, The Netherlands). Cameras were fed into a multiplexer that allowed the image to be recorded using a PC with HandiAvi (v4.3, Anderson's AZcendant Software, Tempe, AZ, USA) at 30 frames per second.

Training: Observers were trained to a pre-determined 20-minute video segment. Inter- and intra-reliability to each other and the trainer was at 90% reliability.

Behaviors and postures: Fifteen pens were randomly selected (5 pens per dietary treatment) and one focal-bird per pen was watched continually between 00:00:00 to 01:00:00 (defined as "first hour of lights on"), 10:00:00 to 11:00:00 (defined as "half way" through the light period) and 19:00:00 to 20:00:00 (defined as "1-h before lights off"). Observers were blinded to dietary treatments. One behavior, two postures and an unknown category were collected (Table 2). Behavioral data will be presented as a percentage of time observed.

Table 2. Ethogram for broiler bird behavior

Measure, % & Seconds	Defined
Active	Standing and walking
Inactive	Lying and sitting
Feeder	Bird head over the feeder circle
Unknown	There was no record of the behavior because lights went off earlier than expected

Statistical analysis: Data were analyzed using SAS software (V 9.4). Percentage of time spent for each behavior was analyzed using a generalized linear mixed model (PROC GLIMMIX) with a Gamma distribution. The statistical model included week (four weeks), dietary treatment (control, flaxseed oil, fish oil), and the week*treatment interaction as fixed effects. One random effect, pen nested within treatment was used. A PDIFF was used to identify significant differences. A P-value ≤ 0.05 was considered to be significant.

Results and Discussion

Percentage of time: The week by dietary treatment interaction was not significant for any broiler behaviors ($P \geq 0.49$). There was no dietary treatment effect observed for any broiler behaviors ($P \geq 0.32$). There was no observed difference for percentage of time spent at the feeder between week 1 and 4 ($P = 0.14$). However, there was a difference for percentage of time spent active ($P < 0.0001$), inactive ($P = 0.0004$) and unknown ($P = 0.01$) between week 1 and 4 (Figure 1).

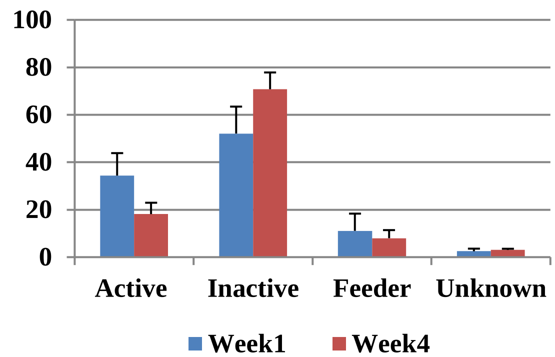

Figure 1: Percentage of time (SE) spent active, inactive & unknown over three hours between weeks 1 and 4.

Conclusion

Within the context of this pilot study, the selected omega-3 dietary sources did not affect broiler behavior between weeks 1 and 4. Independent of dietary treatment, broilers increased the percentage of time spent inactive by week 4 of the study.

Acknowledgements

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