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Methionine, betaine supplementation improves turkey breast meat yield

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The supplementation of methionine varies widely in the industry from deficient to extremely wasteful, said Dr. Sally Noll of the University of Minnesota in a research paper presented at the 2000 Research Review for Decision Makers in Turkey Production, sponsored by the University of Minnesota and the Minnesota Turkey Growers Assn. and held Nov. 28 in Willmar, Minn.

Higher levels of methionine, or total sulfur amino acids (TSAA), have been promoted for turkeys grown in a stressful environment and to increase breast meat yield, she said, noting the study on betaine last year gave somewhat inconclusive results thought to be due to the fact that the birds grew well and the environment was managed to optimize growth.

Thus, Noll said, it was proposed to examine the response to supplemental methionine under management conditions expected to promote maximum feed intake and in a sub-optimal environment with used litter. Betaine, which has been hypothesized to improve performance in sub-optimal rearing environments, was tested in combination with supplemental methionine, she reported.

Noll said the overall objective was to improve breast meat yield in male market turkeys by varying methionine, or TSAA, levels and supplementing betaine. She reported the specific objectives were to determine: (1) the supplemental methionine requirement for gain, feed conversion and breast meat yield of heavy toms; (2) if adding betaine on top of methionine improves carcass yield and breast meat yield, and (3) the effect of a dirty barn environment on performance of male turkeys and their response to supplemental methionine and betaine.

TABLE

1. Performance and the effect of methionine supplementation as a percent of NRC TSAA requirement and supplementation with betaine of diets for market tom turkeys grown in two environments

Treatment	Weight at 11 weeks (lb.)	Weight at 20 weeks (lb.)	Daily intake 5-20 weeks (lb. per bird)	Feed/gain 5-20 weeks	Breast meat yield (%)
1	15.8^{c}	43.3	0.97	2.597	32.44^{c}
2	16.9^{a}	43.8	0.98	2.568	32.94^{bc}
3	17.0^{a}	43.9	0.98	2.600	32.79^{c}
4	17.1^{a}	44.0	0.99	2.590	32.65^{c}
5	16.2^{b}	43.7	0.96	2.562	33.44^{ab}
6	16.9^{a}	44.2	0.98	2.568	33.78^{a}
7	16.9^{a}	44.0	0.99	2.599	33.58^{a}
Clean	16.9^{a}	44.0^{a}	0.98	2.573	33.11
Dirty	16.4^{b}	43.7^{b}	0.98	2.593	33.06

^{a,b,c} Means within a column with different superscripts within diet or environment are statistically different (P<0.05)

Virgil Strangeland of Strangeland Feed Consulting, Willmar, Minn., Jenaine Brannon and Jayne Kalbfleisch cooperated in the research trial conducted at the University of Minnesota's Rosemount Agricultural Experiment Station in Rosemount, Minn.

Methods

The researchers said 1,200 male Nicholas poults were randomly distributed in 50 pens and raised to five weeks of age. Each pen measured 6 x 8 ft. in size. The building was split into two halves with each half containing 50 pens. Heating and ventilation were provided with a negative pressure system. Turkeys were fed high-protein diets to five weeks of age to maximize growth and then were fed the research diets. Poults were placed Oct. 5, 1999, and were marketed at 20 weeks of age on Feb.22, 2000.

Prior to the start of the trial, Noll said, one room of the building was cleaned and disinfected and bedded with fresh wood shavings for brooding. The other room, now designated as the "dirty room," was left dirty from the previous experiment and bedded with used litter, she said. After poults were distributed into the two rooms at five weeks of age, the litter from brooding was removed and replaced with new wood shavings. In the clean environment, litter, ventilation and water were managed for optimal bird comfort, she reported, noting caked bedding was removed frequently and replaced with new wood shavings. Waterers were washed daily. Ventilation was maximized to remove ammonia and bird heat to the extent that similar temperatures could be maintained in both rooms.

In the dirty environment, Noll said, litter conditions were allowed to deteriorate. However, at 11 weeks of age, the concern was expressed that the birds were developing leg problems, so the cake was removed and the litter base stirred in the pens, she reported. Waterers were washed weekly after 11 weeks of age.

Noll said seven dietary treatments were randomly assigned within each of seven blocks of replicate pens within each environment. Diets were formulated for three-week feeding periods of 5-8 weeks, 8-11 weeks, 11-14 weeks, 14-17 weeks and 17-20 weeks of age. Diets contained corn, dehulled soybean meal, canola meal and meat and bone meal, she said. Batches of each ingredient were set aside for use throughout the entire experiment and analyzed for proximates, minerals, betaine and

amino acids. Minimum amino acid requirements as specified by the National Research Council (NRC; 1994) were adjusted in a linear manner for three week feeding periods, Noll said, starting at three weeks of age. Diets were fed in mash form. Canola meal was not used in the last feeding period (17-20 weeks).

Diets were formulated relative to metabolizable energy to reach 94% NRC threonine/protein based on results of a previous study, Noll reported, noting that the desired threonine level set the diet protein level. TSAA was set at 90% NRC in the basal diet. Lysine was set at 110% of NRC. The levels of lysine and methionine were achieved using supplemental amino acids, she said. Noll noted commercial growth promotants were fed.

According to the researchers, the seven dietary treatments fed in each environment (clean and dirty) were: (1) control (base diet described above), (2) diet 1 plus supplemental methionine at 10% NRC TSAA, (3) diet 1 plus supplemental methionine at 20% NRC TSAA, (4) diet 1 plus supplemental methionine at 30% NRC TSAA, (5) diet 1 plus 2 lb. per ton betaine, (6) diet 2 plus 2 lb. per ton betaine and (7) diet 3 plus 2 lb. per ton betaine.

Turkeys were individually weighed at the end of each three-week feeding period and feed use for the period measured, Noll said. The study ended with final weights obtained at 20 weeks of age. At 20 weeks plus one day, the flock was loaded for processing. The flock was processed with cut-up occurring the next day. Breast meat (boneless, skinless) weight was measured from intact carcasses, she said.

Analyses of variance (two-way) were conducted with environment, diet treatment and block (replicate) as main effects, Noll said. Least significant difference was used to determine statistically different treatment means ($P < 0.05$).

Results

Responses to diet were similar in each environment, Noll reported, so the results are presented as main effects (Table). She said bodyweight at 8, 11, 14 and 17 weeks was improved with the addition of methionine compared to the base control diet (treatment 1 versus treatments 2-4, and treatment 5 versus treatments 6-7; Table). No additional weight benefit was obtained by increasing methionine past that of 10% NRC TSAA (treatment 2 versus treatments 3-4, treatment 5 versus treatments 6-7; Table), the research group reported.

According to the group, betaine supplementation improved the bodyweight response in the basal diet (treatment 5 versus treatment 1; Table) at 8 and 11 weeks of age. At 20 weeks, bodyweight differences among diets were no longer significant, Noll said, although the trend existed for the birds fed treatments 1 or 5 to be lower in comparison to the other remaining treatments.

Percentage breast meat yield and amount of breast meat were affected by diet, reported Noll. While methionine additions tended to improve percentage breast meat yield, she said, betaine had the greatest effect, significantly improving yield at each methionine addition.

According to the researchers, the dirty environment depressed bodyweights at 8 and 11 weeks (Table), amounting to a depression of 1.7 and 2.7%, respectively. After litter conditions were improved during the 11-14 weeks period, Noll said, bodyweight differences disappeared until 20 weeks. Even at this time, she noted, the weight depression was relatively minor for the dirty environment amounting to less than 1%.

The goal of the trial was to subject the birds to a dirty environment by not cleaning out the experimental pens and using old litter, Noll said. However, she added, the old litter was susceptible to caking and moisture buildup, which had a negative effect on the legs of the birds. Birds were observed at 11 weeks of age to exhibit "shaky legs" and were hesitant to stand up and walk around. As the trial was not meant to induce growth depression by creating leg problems, Noll said the decision was made to remove the badly caked litter. The birds responded to a greater degree than expected as seen by the recovery in bodyweight, Noll reported.

Study highlights

Noll listed the following conclusions that the research group had from this experiment: -

- For winter-reared market turkey toms, maximal gains and breast meat yield were obtained with diets formulated to 94% threonine/protein relative to the dietary metabolizable energy and supplemented to meet 100% NRC requirement for TSAA. .
- Betaine addition to the methionine-deficient basal diet improved growth at 8 and 11 weeks compared to the unsupplemented diet, perhaps indicating a methionine-sparing role for betaine at sub-optimal dietary TSAA levels in the younger birds.
- Betaine supplementation improved breast meat yield at all levels of methionine supplementation.
- No statistically significant interactions were detected for diet treatment and environment, indicating response to diet was similar in both environments.
- The dirty environment had poorer litter conditions and air quality. However, attention to litter management partially compensated for the poorer, dirty conditions and resulted in only a minor depression in market bodyweight. ¦

KEY WORDS

Betafin, betaine, Betafin(poultry), methionine, turkey, breast meat, breast yield