FEEDING DIETS WITH REDUCED CALCIUM AND PHOSPHORUS ON HYBRID CONVERTER COMMERCIAL TURKEYS: TRIAL #2

Adequate calcium and phosphorus in turkey feeds are required for proper development and mineralization of bone. To successfully grow turkey males to 20 weeks of age and at least 20 kg body weight, strong well-developed legs are essential. In a previous trial, we investigated the possibility of feeding diets lower in calcium and phosphorus than that in our 2013 Commercial Nutrient Guidelines; to assess any effect on growth, feed conversion, mortality and tibia mineralization in Hybrid Converter commercial males grown to 20 weeks of age. We concluded from that trial that diets fed from 6 weeks of age that were 10-15% lower in calcium and phosphorus than that specified in our 2013 Commercial Nutrient Guidelines, did not adversely affect the parameters measured.

We believe that calcium and phosphorus may be unnecessarily over-fortified in some diets fed during the growing period to Hybrid commercial turkeys. Because skeletal development in the commercial turkey is complete at 12-14 weeks of age and that Hybrid strains are genetically selected for well-developed legs; it is possible that later diets in a feed program may be greatly over-fortified with calcium and phosphorus. If this is the case, then, substantial feed cost savings are possible without detriment to overall flock performance. Feeds with lower calcium and phosphorus may also result in decreased barn litter moisture content, better digestion system health of the turkey, and improved feed mill efficiency due to less mono-di-calcium phosphate added to feed.

The effect of further reducing both calcium and phosphorus concentration in diets fed to Hybrid Converter commercial turkeys grown to 20 weeks of age was investigated. The trial was started on March 25, 2014, at the University of Warmia and Mazury in Olsztyn, Poland. A total of 868 Hybrid Converter commercial male turkeys, 1-day of age, were placed in equal numbers to 28 pens that were 10 m^2 each. All turkeys in this trial were fed diets 1 to 3 (Table 1). Beginning at diet 4, equal numbers of pens were assigned to 4 treatments. The individual pens were allocated at this time to specific treatments so that the body weight of the turkeys was equivalent for each treatment. The control (treatment 1) was the same calcium and phosphorus decrease from our previous trial that resulted in no difference in growth, feed conversion and tibia mineralization compared to turkeys fed diets formulated to the 2013 Commercial Nutrient Guidelines. Treatments 2 to 4 in this trial differed from the control in that the calcium and phosphorus decreases were greater (Table 2). All diets were fed by feed amounts as indicated in Table 1, and, all diets contained phytase. All diets contained no meat by-products as mandated by current European regulations, and were manufactured in a feed mill located in Poland.

Table 1: *Nutrient concentration and feed allowance for all experimental diets.*

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Males, weeks of age	0-3	3-6	6-9	9-12	12-16	16-20
Males, kg feed allowance (Converter)	1.04	3.18	5.79	8.84	15.75	19.54
Crude Protein, %	26.5	24.0	21.3	19.2	16.6	15.1
ME, MJ/kg	11.51	11.72	12.14	12.56	12.87	13.19
ME, kcal/kg	2750	2800	2900	3000	3075	3150
Available lysine, %	1.56	1.41	1.32	1.17	0.95	0.79
Total lysine, %	1.74	1.58	1.47	1.32	1.06	0.89
Total sodium, %	0.16	0.16	0.17	0.17	0.17	0.17

Table 2: *Calcium and phosphorus concentrations for all experimental diets.*

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
TREATMENT 1						
Total calcium (analytical, without phytase), %	1.35	1.26	1.06	0.90	0.75	0.70
Total calcium (analytical, with phytase), %	1.25	1.16	0.96	0.80	0.65	0.60
Available phosphorus, %	0.72	0.67	0.53	0.45	0.37	0.35
% decrease from 2013 Hybrid Nutrient Guidelines	0	0	10	15	15	15
TREATMENT 2						
Total calcium (analytical, without phytase), %	1.35	1.26	1.06	0.82	0.68	0.62
Total calcium (analytical, with phytase), %	1.25	1.16	0.96	0.72	0.58	0.52
Available phosphorus, %	0.72	0.67	0.53	0.41	0.34	0.31
% decrease from 2013 Hybrid Nutrient Guidelines	0	0	10	22.5	22.5	22.5
TREATMENT 3						
Total calcium (analytical, without phytase), %	1.35	1.26	1.06	0.74	0.62	0.56
Total calcium (analytical, with phytase), %	1.25	1.16	0.96	0.64	0.52	0.46
Available phosphorus, %	0.72	0.67	0.53	0.37	0.31	0.28
% decrease from 2013 Hybrid Nutrient Guidelines	0	0	10	30	30	30
TREATMENT 4						
Total calcium (analytical, without phytase), %	1.35	1.26	1.06	0.74	0.56	0.48
Total calcium (analytical, with phytase), %	1.25	1.16	0.96	0.64	0.47	0.38
Available phosphorus, %	0.72	0.67	0.53	0.37	0.28	0.24
% decrease from 2013 Hybrid Nutrient Guidelines	0	0	10	30	35	40

All feeds were formulated to available amino acids. Amino acid to lysine ratios were as detailed in 2013 Hybrid Nutrient Guidelines. Diets 1 to 3 are the same for all treatments. Treatment differences begin at Diet 4.

Body weights of the turkeys for each treatment were not significantly ($P>0.05$) different at any time measured (Table 3). Livability in all treatments was excellent and was at 20 weeks of age; 95.86% for treatment 1; 93.55% for treatment 2; 98.16% for treatment 3; and 95.4% for treatment 4. Feed conversion (corrected for mortality) at 20 weeks of age was similar for all treatments, and was; 2.566 ± 0.046 for treatment 1; 2.568 ± 0.036 for treatment 2; 2.554 ± 0.058 for treatment 3; and 2.557 ± 0.050 for treatment 4.

Table 3: *Body weights of male turkeys (kg/poult).*

Weeks of age	Treatment 1	Treatment 2	Treatment 3	Treatment 4	P value
0	0.056 ± 0.000	0.056 ± 0.001	0.056 ± 0.000	0.056 ± 0.001	0.607
3	0.795 ± 0.011	0.793 ± 0.024	0.777 ± 0.020	0.787 ± 0.009	0.180
6	2.997 ± 0.074	2.984 ± 0.100	2.960 ± 0.076	2.968 ± 0.043	0.807
9	6.356 ± 0.276	6.360 ± 0.296	6.366 ± 0.094	6.341 ± 0.234	0.998
12	10.561 ± 0.184	10.574 ± 0.361	10.490 ± 0.219	10.371 ± 0.317	0.521
16	16.032 ± 0.509	16.146 ± 0.497	16.103 ± 0.417	15.952 ± 0.508	0.885
20	20.377 ± 0.727	20.634 ± 0.795	20.278 ± 0.811	20.525 ± 0.683	0.822

Carcass yield results at 20 weeks of age were not significantly (P>0.05) different among treatments (Table 4). In the slaughter house, all poults were numerically scored for footpad dermatitis by two independent persons. The scoring was done according to the method outlined by Hocking *et al.*, 2008. No significant (P>0.05) differences were measured among the treatments. Dry matter concentration in fecal droppings collected at 8, 12, 16 and 20 weeks of age were not significantly (P>0.05) different among treatments.

Table 4: *Carcass yield of male turkeys.*

Measurement	Treatment 1	Treatment 2	Treatment 3	Treatment 4	P value
Live body weight (kg)	20.357 ± 0.532	20.614 ± 0.926	20.314 ± 0.426	20.514 ± 0.398	0.778
Carcass weight w/o neck, chilled (kg)	15.487 ± 0.658	15.829 ± 0.536	15.434 ± 0.436	15.706 ± 0.238	0.413
Dressing, %	76.07 ± 2.23	76.82 ± 0.91	75.98 ± 1.62	76.58 ± 1.70	0.753
Breast muscle, % live weight	23.75 ± 1.42	24.27 ± 0.76	23.83 ± 1.30	25.08 ± 1.49	0.218
Thigh muscle, % live weight	10.80 ± 1.01	11.24 ± 0.63	11.12 ± 0.61	11.15 ± 0.71	0.719
Drumstick, % live weight	7.92 ± 0.41	8.31 ± 0.46	8.12 ± 0.86	7.86 ± 0.52	0.479

7 poults per treatment measured

Tibia ash was not significantly (P>0.05) different among treatments (Table 5). However, there were significant (P<0.05) differences between treatments for tibia calcium and phosphorus concentration. The lowest feed calcium and phosphorus treatment (treatment 4) did result in the lowest concentration of calcium and phosphorus measured in the tibia. This treatment, however, performed well in body weight gain, feed conversion and carcass yield. Although the leg soundness of the poults were acceptable in treatment 4, it does appear from the tibia mineral analyses that we are approaching the maximum limits that the amount of calcium and phosphorus can be safely decreased in feed.

Table 5: *Tibia mineralization of male turkeys.*

Measurement	Treatment 1	Treatment 2	Treatment 3	Treatment 4	P value
Ash, %	64.14 ± 0.86	63.43 ± 1.32	63.63 ± 1.41	62.44 ± 1.23	0.097
Calcium, %	23.33 ± 0.44	22.82 ± 0.81	23.03 ± 0.63	22.19 ± 0.46	0.012
Phosphorus, %	10.70 ± 0.21	10.56 ± 0.29	10.55 ± 0.24	10.17 ± 0.17	0.002

7 poults per treatment measured

Economic returns at 20 weeks of age were better in some treatments with lower calcium and phosphorus in feed. Feed cost per kg body weight relative to treatment 1 was 0.85% higher in treatment 2, 1.57% lower in treatment 3, and 1.44% lower in treatment 4. In our previous trial, there was a 2.23% lower feed cost per kg body weight at 20 weeks of age when comparing the equivalent calcium and phosphorus decrease as treatment 1 of this trial with feeds formulated to levels stated by the 2013 Commercial Nutrient Guidelines.

The present trial indicates that calcium and phosphorus can be safely decreased below that stated in our 2013 Commercial Nutrient Guidelines for Hybrid Converter males. The adjustment can be done in feeds fed from 6 weeks of age. In this trial, the vitamin D_3 amounts in feed for all treatments were 5,000 IU/kg in diets 1 to 3; and, 4,800 IU/kg in diets 4 to 6. We have not investigated the effect of much lower D_3 levels in feed on poults fed diets formulated with calcium and phosphorus concentrations well below our guidelines. We have not repeated this trial with Hybrid XL or Grademaker males, however, reduction of calcium and phosphorus in amounts similar to that of treatment 1 or 2 are likely feasible to apply to these strains. We plan to repeat this study with Converter females. Extrapolation of the male data in this study to females would indicate that calcium and phosphorus reductions similar to that in treatment 1 or 2 are likely also feasible to apply.

References:

Hocking, P.M., R.K. Mayne, R.W. Else, N.A. French, and J. Gatcliffe (2008). Standard European footpad dermatitis scoring system for use in poultry processing plants. World's Poultry Science Journal 64 (3):323-328.