THE EFFECT OF DIFFERENT LEVELS OF PHOSPHORUS AND CALCIUM ON THE BODY WEIGHT OF GROWING TURKEYS[1]

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A previous paper from this station (1) has reviewed the literature with respect to phosphorus and calcium requirements of growing turkeys. The recommendations indicated that a 1.0 percent level of phosphorus and 2.0 percent level of calcium were required for maximum growth. The results of the work reported in the previous paper were found to agree with these recommendations. Most of the experiments upon which the recommendations were based were concluded when the poults reached 4 weeks of age. In order to ascertain the effects of varied levels of phosphorus and calcium on the growth of the turkey from day old to 24 weeks of age, the following experiment was performed.

EXPERIMENTAL

Approximately 250 Broad Breasted Bronze poults and 250 Beltsville Small White poults were wingbanded and distributed equally into 10 experimental pens. The poults were housed in an electrically heated battery brooder for the first 4 weeks, in a brooder house from 4 to 12 weeks of age and in range shelters with access to rape and oats pasture from 12 to 24 weeks of age. The poults had free access to feed and water at all times.

The diets are shown in Tables I and II. The protein level was adjusted to approximately 28, 25, and 20 percent for the periods 0 to 4, 4 to 8, and 8 to 12 weeks of age respectively. Three levels of phosphorus were fed for the first 12 weeks and four levels fed from 12 to 24 weeks as outlined in Table III. A commercial grade of dicalcium phosphate was used as a source of supplemental phosphorus and ground limestone was used to adjust the level of calcium in the diet to the ratio of 2:1 with total phosphorus. Chemical analyses were made of the diets to check on actual levels of calcium and phosphorus. The results of the chemical analyses are compared with the calculated levels of phosphorus and calcium in Table IV.

Body weights were recorded every four weeks during the experiment and the turkeys were sexed by observation of outward physical appearance at the 24-week of age weighing date.

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TABLE I

PERCENT COMPOSITION OF THE EXPERIMENTAL DIETS
0-12 WEEK DIETS

Ingredient	Diet 1a*	b*	c*
Ground yellow corn	27	38	38
Ground oats	5	5	20
Wheat middlings	5	5	5
Alfalfa meal	5	5	5
Soybean oil meal (44%)	43	35	20
Dried buttermilk	3	3	3
Fish meal	3	3	3
Dried brewers' yeast	3	0	0
Meat and bone scraps	3	3	3
Salt (2½% $MnSO_4$)	0.5	0.5	0.5
Dicalcium phosphate	0	0	0
Ground limestone	2	2	2
Vitamins, antibiotic, etc.**	0.3	0.3	0.3
	Diet 2a	b	c
Ground yellow corn	26	37	37
Dicalcium phosphate	1	1	1
Ground limestone	2	2	2
Other ingredients same as Diet 1			
	Diet 3a	b	c
Ground yellow corn	24.5	35.5	35.5
Dicalcium phosphate	2	2	2
Ground limestone	2.5	2.5	2.5
Other ingredients same as Diet 1			

*Diets 1a, 2a and 3a were fed 0-4 weeks, 1b, 2b and 3b were fed 4-8 weeks and 1c, 2c and 3c were fed 8-12 weeks.

**Riboflavin .46 mg., Niacin 8 mg., Calcium Pantothenate 3 mg., Procaine Penicillin 2mg., Choline 46 mg., Methionine 46 mg., Vitamin A 3400 I. U. and Vitamin D 900 AOAC chick units per pound of mixed diet.

TABLE II
12-24 WEEK DIETS

Ingredients	Diet 4	Diet 5	Diet 6	Diet 7
Ground yellow corn	45.0	43.6	42.3	41.0
Ground oats	20	20	20	20
Wheat middlings	5	5	5	5
Alfalfa meal	5	5	5	5
Soybean oil meal (44%)	20	20	20	20
Dried buttermilk	3	3	3	3
Salt (2½% $MnSO_4$)	0.5	0.5	0.5	0.5
Dicalcium phosphate	0	0.9	1.9	2.9
Ground limestone	1.5	2.0	2.3	2.6
Vitamins, antibiotic, etc.*				

*Riboflavin 1 mg., Calcium Pantothenate 3 mg., Niacin 8 mg., Procaine Penicillin 2 mg., Vitamin A 3400 I. U. and Vitamin D 900 AOAC chick units per pound of mixed diet.

TABLE III

EXPERIMENTAL PLAN INDICATING ASSIGNMENT OF DIETS TO PENS

	0-12 week diets		
	Diet 1	Diet 2	Diet 3
12-24 week diets	pen	pen	pen
Diet 4	1	3	2
Diet 5	5	7	4
Diet 6		9	6
Diet 7			8 & 10

TABLE IV

COMPARISON OF CALCULATED LEVELS OF PHOSPHORUS AND CALCIUM WITH THE RESULTS OF CHEMICAL ANALYSES FOR THESE ELEMENTS

Diets		1a	1b	1c	2a	2b	2c	3a	3b	3c
Calculated	P	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.0
	Ca	1.2	1.2	1.2	1.6	1.6	1.6	2.0	2.0	2.0
Chemical	P	.68	.71	.60	1.02	.89	.88	1.17	1.08	1.02
	Ca	1.45	1.48	1.55	1.86	1.68	1.77	2.13	2.26	2.16

Diets		4	5	6	7
Calculated	P	0.4	0.6	0.8	1.0
	Ca	0.8	1.2	1.6	2.0
Chemical	P	0.60	.72	.89	1.12
	Ca	.85	1.28	1.75	2.26

RESULTS AND DISCUSSION

The body weights for 4, 12, and 24 weeks of age are shown in Table V. At 4 weeks of age the diet with the calculated levels of 0.8 percent phosphorus and 1.6 percent calcium (which analyzed 1.02 and 1.86 percent respectively) produced a slighter higher average weight than did the other two levels of phosphorus and calcium. This is in accord with other reports. The differences in growth between diets was found to be significant at the 5 percent level when both breeds were combined in analyses of variance.

TABLE V

AVERAGE BODY WEIGHTS OF TURKEYS AT 4, 12 AND 24 WEEKS OF AGE WITH RESPECT TO CALCULATED LEVELS OF PHOSPHORUS. (AV. WT. OF MALES PLUS AV. WT. OF FEMALES AND THE TOTAL DIVIDED BY 2).

	BBB		BSW	
	4 weeks	12 weeks	4 weeks	12 weeks
% P	lb	lb	lb	lb
0.6	1.24	7.8	.98	5.1
0.8	1.30	7.6	.99	5.0
1.0	1.24	7.7	.95	5.3

	BBB			BSW		
	0-12 week diets			0-12 week diets		
12-24 week diets	0.6 lb	0.8 lb	1.0 lb	0.6 lb	0.8 lb	1.0 lb
0.4	17.0	16.7	17.2	11.5	11.1	11.1
0.6	16.8	17.1	17.6	10.2	10.2	10.6
0.8		18.4	17.8		11.5	11.6
1.0			17.8			11.6

At 12 weeks of age, the two breeds showed different responses to the diets. The Broad Breasted Bronze poults on the calculated 0.6 percent phosphorus and 1.2 percent calcium diet (chemical analyses 0.60 and 1.55 percent respectively) had gained more than the BBB poults on the other diets. The Beltsville Small White poults receiving the top level of phosphorus and calcium (chemical analyses of 1.02 and 2.16 percent respectively) gained more than did BSW poults on the other diets. Here again analyses of variance showed differences significant at the 5 percent level.

At 24 weeks the BBB turkeys showing greatest body weight were those receiving the calculated level of 0.8 percent phosphorus and 1.6 percent calcium during all of the growing period. The chemical analyses show considerable variance from the calculated levels and accordingly the birds actually received phosphorus levels of approximately 1.0 percent the first 4 weeks and 0.9 percent from 4 to 24 weeks of age.

The BSW turkeys showed greatest body weight for birds started on 1.0 percent calculated phosphorus level and finishing on either 0.8 or 1.0 percent calculated phosphorus level. Here again the chemical analyses showed the birds getting approximately 1.1 percent phosphorus and 2.2 percent calcium the first 8 weeks, 1.0 percent phosphorus and 2.2 percent calcium from 8 to 12 weeks and then finishing on either 0.9 or 1.1 percent phosphorus and 1.8 or 2.2 percent calcium respectively. The analyses of variance for the 24-week of age data proved to be too complex for ready computation and, therefore, the signifiance of the differences is not known.

The amounts of phosphorus and calcium that the turkeys may have received from the green forage during the 12 to 24-week of age period was not determined and is ,therefore, a matter of speculation. It may have been sufficient to enable some of the turkeys receiving low phosphorus diets to attain greater body weight than would have been the case if the turkeys had not had access to forage.

SUMMARY

The evidence presented indicates that turkey starter diets should contain approximately 0.9 to 1.0 percent of total phosphorus and 1.8 to 2.0 percent total calcium.

A breed difference appears to influence the need for phosphorus in growing turkeys of 10 to 12 weeks of age. For Broad Breasted Bronze the phosphorus requirement for this period appears to be in the range of 0.9 to 1.1 percent with calcium about 1.8 to 2.2 percent. For Beltsville Small Whites a slightly higher level of phosphorus, 1.1 percent, with calcium at 2.0 to 2.2 percent appears to be most desirable.

The standard recommendation of 1.0 percent phosphorus and 2.0 percent calcium remains valid according to these findings.

BIBLIOGRAPHY

1. Wilcox, R. A., C. W. Carlson, Wm. Kohlmeyer and G. F. Gastler. Calcium and phosphorus requirements of poults fed purified diets. Poultry Science **32**, 1030-1035 (1953).