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STRAIN DIFFERENTIAL IN AMINO ACID REQUIREMENTS FOR LAYING HENS

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This study involved the effects of amino acid supplementation of a low protein layer diet on egg production of two strains of chickens.

The control (diet 1) in this experiment was a typical 16% protein corn-soy diet. The low protein diet (diet 2) was approximately 10% protein and was obtained by replacing some of the soybean meal with additional corn. Diet formulations are given in tables 1 and 2. Two strains of Leghorn type layers were fed the diets using 16 birds from each strain per diet. The birds were housed two per cage, resulting in eight replications of the treatments. The strains used were a random-bred strain and a commercial strain (DeKalb-271). The study was conducted for ten 28-day periods following a 12-week depletion phase in which all birds on the low protein treatments were fed the diet of treatment 3. Data were collected to provide calculations for both percent hen-day production and grams of egg produced per day, average egg weight, feed consumption, Haugh units, feed efficiency and mortality. Values presented in tables 3 and 4 are the means of ten periods.

With the birds housed two per cage, occasionally neither of the hens would lay any eggs in a period. This would result in no measurement being obtained from that cage for that period as to average egg weight, Haugh units and feed per dozen eggs. Only data from cages with hens producing eggs were considered for these measurements.

There were significant dietary and strain differences in average egg weight as shown in table 3. The heaviest eggs came from the commercial strain on both the control diet and the low protein diet with threonine in the supplement (diet 6). Also in the commercial strain, eggs from hens fed the low protein diets supplemented with amino acids (diets 3-7) were heavier than those from hens fed the nonsupplemented diet (diet 2). However, for the random-bred strain, none of the differences between the supplemented and nonsupplemented low protein diets were significant. Kilograms of feed required per dozen eggs are shown for each treatment in table 3. Hens of both strains on diets containing valine in the supplement (diet 5) and hens of the commercial strain on the diet containing the low level of methionine (diet 3) did not perform as well as those on other treatments. The Haugh unit measurement revealed that, although the nonsupplemented low protein treatment produced lighter eggs, they were of better quality. For both strains, eggs from hens on all amino acid supplemented low protein diets scored at least as well as the controls, see table 3.

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When considering all cages, there were significant dietary effects on egg production in terms of grams of egg produced per day (table 4). For the commercial strain, the low protein diet supplemented with 0.20% DL-threonine (diet 6) supported production equal to that of the controls. Addition of L-arginine (diet 7) showed no effect on production. These effects were not seen with the random-bred strain. Although the differences between the low protein and methionine supplemented diets were not significant, it appears that the requirements for methionine differ between the strains. The 0.40% level of methionine (diet 4) improved production compared to the 0.30% level (diet 3) for the commercial strain but did not for the random-bred strain. There were no significant strain or diet effects on percent hen-day production, see table 4. Hen-housed mortality was not affected by strain or diet and averaged 1.16% for the entire flock. There also were no strain effects on feed consumption.

In summary, due to a high degree of variability among the cages, there were no significant dietary effects on percent hen-day egg production. However, production of eggs measured in grams per day was decreased by the low protein diets. For hens of the commercial strain, production with the diets containing 0.20% DL-valine and 0.20% L-arginine in the supplement was not different from the controls. The average egg weight was decreased by the low protein diet. Amino acid supplementation of the low protein diet tended to counteract this decrease. Feed per dozen eggs was higher for hens of both strains on diets containing 0.20% supplemental DL-valine. The diet with 0.30% supplemental DL-methionine was not utilized as efficiently by the commercial strain. Hen-housed mortality was not affected by strain or diet.

Further studies are planned to investigate the lysine requirement as influenced by the other amino acids.

Table 1. Diet Formulations

Ingredient	Control diet	Low protein diet
	%	%
Corn	70.7	85.4
Soybean meal	19.8	4.1
Dehydrated alfalfa meal	2.0	3.0
Dicalcium phosphate	1.5	1.5
Limestone	5.0	5.0
Salt and vitamins	1.0	1.0

Table 2. Treatments

Number	Description
1	Control diet
2	Low protein diet
3	Low protein diet + 0.20% L-lysine + 0.15% DL-tryptophan + 0.25% DL-isoleucine + 0.30% DL-methionine
4	As 3 + 0.10% DL-methionine (total 0.40%)
5	As 4 + 0.20% DL-valine
6	As 5 + 0.20% DL-threonine
7	As 6 + 0.20% L-arginine

Table 3. Egg Production Response to Amino Acid Supplementation of Low Protein Diets as Influenced by Strain

		Means of ten 28-day periods		
Diet	Treatment	Average egg wt.[1]	Feed per dozen eggs	Haugh units
		g	kg	
	Commercial Strain			
1	Control diet	65.22a[2]	2.416a	80.75cd
2	Low protein diet	59.03ef	2.795a	86.17a
3	Low protein + supplement[3]	62.24bc	4.972b	81.77c
4	As 3 + 0.10% DL-methionine	61.70bc	2.910a	82.16c
5	As 4 + 0.20% DL-valine	61.09cd	3.946ab	81.34c
6	As 5 + 0.20% DL-threonine	63.47ab	2.461a	83.90b
7	As 6 + 0.20% L-arginine	61.45cd	2.547a	81.04cd
	Random-bred Strain			
1	Control diet	59.70de	3.211a	72.47g
2	Low protein diet	56.69gh	2.858a	79.58de
3	Low protein + supplement	56.66gh	2.792a	74.14fg
4	As 3 + 0.10% DL-methionine	58.19efg	2.920a	74.76f
5	As 4 + 0.20% DL-valine	57.68fgh	3.794ab	75.47f
6	As 5 + 0.20% DL-threonine	55.94h	3.102a	78.36e
7	As 6 + 0.20% L-arginine	57.92efg	3.219a	78.21e

[1] Data for hens in production only.
[2] Means with different letters are significantly different ($P<.01$).
[3] Supplement consists of 0.20% L-lysine + 0.15% DL-tryptophan + 0.25% DL-isoleucine + 0.30% DL-methionine.

Table 4. Egg Production Response to Amino Acid Supplementation of Low Protein Diets as Influenced by Strain

Diet	Treatment	Means of ten 28-day periods: Hen-day Egg production		Feed consumption
		%[1]	g/day	g
	Commercial Strain			
1	Control diet	63.43[2]	41.36a[3]	113[2]
2	Low protein diet	46.53	27.31b	101
3	Low protein diet + supplement[4]	40.11	24.80b	95
4	As 3 + 0.10% DL-methionine	50.69	31.24b	98
5	As 4 + 0.20% DL-valine	50.19	30.73b	104
6	As 5 + 0.20% DL-threonine	53.59	33.96ab	106
7	As 6 + 0.20% L-arginine	54.53	33.42ab	104
	Random-bred Strain			
1	Control diet	52.44	31.40b	102
2	Low protein diet	47.25	26.80b	101
3	Low protein diet + supplement	53.30	30.21b	104
4	As 3 + 0.10% DL-methionine	46.94	27.22b	99
5	As 4 + 0.20% DL-valine	48.05	27.89b	101
6	As 5 + 0.20% DL-threonine	49.89	27.91b	106
7	As 6 + 0.20% L-arginine	48.64	27.93b	101

[1] All hens, producers and nonproducers.
[2] No significant effects.
[3] Means with different letters are significantly different (P<.01).
[4] Supplement consists of 0.20% L-lysine + 0.15% DL-tryptophan + 0.25% DL-isoleucine + 0.30% DL-methionine.