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One hundred twenty-seven 18-month old hens were placed on a 16% protein layer diet containing no supplemental vitamin D_3. Egg weight, breaking strength, and shell thickness were measured on one egg per hen each week. After 19 weeks, the hens were divided into six treatment groups. Groups 1 and 2 were fed the original diet plus 24 and 48 µg D_3 per kg of diet, respectively. Treatment groups 3 and 4 were supplemented with 6 and 12 µg of $1,25\text{-}(OH)_2\text{-}D_3$ per kg of diet, and groups 5 and 6 were treated with 6 and 12 µg of $24,25\text{-}(OH)_2\text{-}D_3$. Treatment was maintained for 16 weeks. During the first 7 weeks, one egg per hen per week was taken for weight, breaking strength and shell thickness measurements and thereafter every egg was measured.

During the first 7 weeks of dietary treatment, there was an appreciable increase in all egg parameters across all treatments as shown in Table 1. Egg weight dropped through the final 9 weeks to nearly the same levels shown during the weeks on the D_3-free diet. Overall, breaking strength and shell thickness levels were maintained satisfactorily throughout the duration of the experiment.

When treatment groups were compared with each other, Diets 2 and 4, the higher levels of D_3 and $1,25\text{-}(OH)_2\text{-}D_3$, showed consistently significantly superior results across all three egg characteristics. However, this was only during the first 7 weeks. In the last 9 weeks, the breaking strength of the eggs from hens on Diet 2 dropped to among the lowest of the six diets, and the shell thickness of eggs from hens on Diet 4 increased slightly and remained among the highest values. The other parameters for Diets 2 and 4 dropped to moderate levels when compared to the four remaining diets.

The two "extreme" diets, the lower level of D_3 (Diet 1) and the higher level of $24,25\text{-}(OH)_2\text{-}D_3$ (Diet 6), showed generally poor effectiveness on improving shell strength and thickness for the first 7 weeks as compared to Diets 2 through 5. Diet 1 was effective in maintaining egg weights which compared favorably with egg weights from hens fed Diets 2 and 4.

Based on these results, there does appear to be some advantage for the use of the vitamin D metabolites in egg calcification with aged hens. Further evaluation of their effectiveness awaits analyses of the enzymes involved in calcification.

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Table 1. Weight, breaking strength and shell thickness as affected by age and vitamin D_3 and its metabolites

Period[1]	Diet[2]	Egg weight	Breaking strength	Shell thickness
		g	kg	X.01 mm
A	1	63.28a	2.25a	27.97b
	2	61.44b	2.21b	27.57c
	3	62.38b	2.17c	27.70c
	4	61.62b	2.17c	27.97b
	5	62.01b	2.22b	28.26a
	6	62.47b	2.21b	27.46c
	Avg	62.20	2.21	27.82
B	1	64.76a	2.42c	30.15b
	2	64.57a	2.55a	31.06a
	3	64.88a	2.48b	31.34a
	4	65.08a	2.55a	31.21a
	5	64.06b	2.46b	30.90a
	6	64.24b	2.40c	30.16b
	Avg	64.59	2.48	30.81
C	1	64.04a	2.35d	30.14b
	2	62.71b	2.34d	29.90b
	3	62.09b	2.64a	31.53a
	4	62.44b	2.50b	31.36a
	5	61.77b	2.51b	31.74a
	6	60.59c	2.44c	30.40b
	Avg	62.27	2.47	30.84

[1] Periods and eggs as follows:
A = group average of one egg per hen per week for 19 weeks of D_3-free diet
B = group average of one egg per hen per week for first 7 weeks of treatment
C = group average of every egg per hen for last 9 weeks of treatment.

[2] Dietary treatments as follows:
1 = 24 µg D_3 per kg diet
2 = 48 µg D_3 per kg diet
3 = 6 µg 1,25-$(OH)_2$-D_3 per kg diet
4 = 12 µg 1,25-$(OH)_2$-D_3 per kg diet
5 = 6 µg 24,25-$(OH)_2$-D_3 per kg diet
6 = 12 µg 24,25-$(OH)_2$-D_3 per kg diet.

[a,b,c,d] Means with unlike subscripts within a group are significantly different ($P<0.05$).