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EFFECT OF DIFFERENT PROTEIN LEVELS OF THE PERFORMANCE OF LAYING BIRDS IN A TROPICAL ENVIRONMENT

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A study was conducted with laying birds of the Harco commercial strain to establish the optimum level of dietary protein required for the highest egg production rate and egg size in Nigeria. The results show that increasing the dietary protein level from 16 to 18% significantly ($P < 0.05$) increased average hen-day production percentage, feed efficiency and average egg weight. Increasing the quantity of protein fed beyond the 18% level did not significantly affect any of these factors. From the results of the study it would appear that the 18% protein level is adequate for maximum egg production, egg weight and feed efficiency in a tropical environment.

Key Words: Poultry, egg production, protein level

Efficient livestock production in the tropical regions of the world should rely less on the nutrient requirement tables compiled in the temperate countries, signifying the compilation of nutrient requirement tables based on research studies conducted in the tropics. One of the nutrients on which information has not been clearly given is the protein requirement of laying birds in the tropical environment so that the optimum level of protein for egg production can be fed. This is important since excess dietary protein level may be economically wasteful while suboptimal levels have been shown by some workers to lead to decreased egg production (Novacek and Carlson 1969; Harms and Damron 1969).

The study was therefore conducted to determine the optimum level of dietary protein for maximum egg production in a tropical environment.

Materials and Methods

A total of one hundred and ninety two laying birds of the Harco commercial strain which were two weeks in lay were randomly divided into four equal treatment groups of 48 birds each and these were further subdivided into four replicate groups of 12 birds each. Replicate groups were similar in weight and birds were paired in cages. The four treatments (Table 1) consisted of rations with 16, 18, 20 and 22% dietary protein levels. The ingredients used in compounding the rations were adjusted to maintain uniform levels of energy, calcium and phosphorus. Feed samples were analysed for proximate composition according to the methods outlined in the Official Methods of Analysis published by the Association of Official Analytical Chemists (1975).

Table 1:
Percentage composition of experimental rations (air-day basis)

	Protein level %			
	16	18	20	22
Ingredients				
Yellow maize	51.5	61.0	59.5	57.0
Groundnut cake	10.5	17.0	22.8	24.2
Fish meal	3.5	4.0	5.0	7.95
Brewers' dried grain	13.95	7.45	2.45	1.0
Bone meal	2.5	2.5	2.2	1.8
Oyster shell	7.0	7.0	7.0	7.0
Vitamin-mineral mix[1]	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Amprolium (a coccidiostat)	0.05	0.05	0.05	0.05
Total	100.0	100.0	100.0	100.0
Analysis				
Crude protein (%)	16.2	18.02	20.0	22.0
Crude fibre	7.2	6.63	6.2	6.0
ME (kcal/kg), calculated	2805.5	2803.3	2802.0	2802.5
Calcium (%)	3.5	3.6	3.5	3.5
Phosphorus, available (%)	0.5	0.5	0.5	0.5
Lysine, calculated (%)	0.6	0.7	0.79	1.0
Methionine + cystine, calculated (%)	0.6	0.6	0.7	0.8

[1] A Pfizer livestock feeds product, Ikeja, supplying the following per kg of diet: vitamin A, 8000 iu; D_3, 2000 i.u.; riboflavin, 4.20 mg; pantothenic acid, 5.0 mg; nicotinic acid, 20.0 mg; folic acid, 0.5 mg; choline, 300 mg; vitamin B_{12}, 0.01 mg; vitamin K, 2.0 mg; vitamin E, 2.5 mg; manganese, 56 mg; iodine, 1.0 mg; iron, 20.0 mg; copper, 10.0 mg; zinc, 50.0 mg; cobalt, 1.25 mg

The birds were fed for two weeks on the experimental diets before data collection started. Feed and water were provided ad libitum. Eggs were collected daily from the time the birds had completed the 1st month in lay till the end of the 9th month in lay. The records of daily egg production for all the replicate groups were kept throughout the experimental period. Average hen-day production percentages were calculated from the total number of eggs collected, expressed as percentages of the expected number of eggs for each group per month over the eight months period. Eggs laid during the last five days of each month were kept together and weighed on a replicate basis. The records of replicate group feed consumption were also kept for each month. From the records of feed consumed and eggs laid, the feed consumed per dozen eggs laid was also calculated for the four treatment groups. The birds were weighed at the end of the experimental period and the changes in body weight recorded.

Data collected were statistically analysed to test the significance of differences observed, followed by the Duncan's Multiple Range Test as outlined by Steel and Torrie (1960) wherever significant differences were indicated.

Results and Discussion

The results on the laying performance are presented in Table 2 while the body weight changes are presented in Table 3. Increasing the dietary protein level from 16 to 18% significantly (P<0.05) increased the average hen-day production percentage. Increasing the quantity of protein fed beyond the 18% level did not significantly affect the hen-day production percentage. The feed efficiency values and the values for the egg weight also showed significant (P < 0.05) increases when the level of dietary protein increased from 16 to 18%. These two factors were however not significantly affected when the protein fed was increased to 20 and 22% levels. In establishing the optimum protein level for laying birds, a number of workers (Deaton and Quisenberry 1964; Quisenberry et al 1964; Novacek and Carlson 1969) have reported decreased egg production, egg size and feed efficiency at the suboptimal protein levels. Looking at the parameters of hen-day production percentage, feed efficiency and egg weight, it appears that under the conditions of this experiment, the 18% level of dietary protein was the level beyond which these factors were not significantly affected.

Table 2:
Effect of level of dietary protein on laying performance

	Level of dietary protein, %				
	16	18	20	22	+ SEM[1]
Average hen-day production (%)	69.16[b]	74.69[a]	72.08[ab]	72.22[ab]	1.08*
Average Feed intake/bird/day (g)	151.43[a]	145.01[a]	143.33[a]	144.70[a]	2.83[ns]
kg Feed/dozen eggs	2.63[a]	2.43[b]	2.40[b]	2.41[b]	0.06*
Average egg weight (g)	56.76[a]	58.26[b]	58.26[b]	58.45[b]	0.30*

a,b Treatment means in the same row not followed by the same letter are significantly different from one another (P < 0.05)

* Significant differences among treatment means (P < 0.05)

ns No significant difference

The results of feed intake per bird per day were not significantly affected by the different protein levels. The birds on the lowest protein level of 16% however consumed a greater quantity of feed than the birds on the other protein levels. Perhaps the higher, but non-significant, level of feed intake at the lowest protein level of 16% was due to an effort by the birds on the 16% protein level to increase their protein level to increase their protein intake for optimum laying performance. Smith (1967) and Novacek and Carlson (1969) have reported that hens will exceed their energy requirements to meet protein or amino acid requirements, thus attempting to maintain an equilibrium in their nitrogen balance.

The results of the body weight gain show that as the level of dietary protein fed increased, the body weight gain increased though non-significantly. Similar results have been reported by Smith (1967) and Harms and Damron (1969).

Table 3:

Effect of level of dietary protein on body weight changes

	Level of dietary protein, %				
	16	18	20	22	± SEM[1]
Initial average weight (g)	1814.29	1804.22	1792.50	1808.93	-
Final average weight (g)	2200.00	2208.14	2199.53	2263.99	-
Average weight gain (g)	385.71[a]	403.92[a]	407.03[a]	455.06[a]	23.77[ns]

1 Only the values for the average gain were statistically analysed

a Treatment means followed by the same letter are not significantly different

ns No significant difference

While the National Research Council (1971) put the protein requirement of laying birds at 15%, Milton and Ingram (1957) put it at 18%. Babatunde and Fetuga (1976) working in a tropical environment recommended a value of 16% protein. It is important however to note that in making their recommendation, Babatunde and Fetuga used laying birds which were already 6 months in production. By the time the birds were 6 months in lay they would have gone beyond the peak production period and so would have needed less protein than those just approaching peak production. Also from the 6th month in production the birds might have been more mature and so would not have needed part of the protein for growth as would be the case when the birds are starting to lay.

Under the conditions of this experiment, it would appear that 18% protein level was the optimum requirement for maximum of egg production, egg weight and feed efficiency in the tropical environment.

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