*Iran. Jour. Agric. Res. Vol. 1, No. 2, March 1972*

# COMPARISON OF TWO PROTEIN LEVELS ON LAYING HENS PERFORMANCE

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## ABSTRACT

To compare the effect of two levels of dietary protein (14 and 17 percent) in performance of laying hens under two seasonal conditions (spring and summer), 60 Leghorn and 60 New Hampshire pullets at six months of age were used in a completely randomized design. The experiment was run for six months during spring and summer. Cotton seed meal and fish meal were substituted for barely in order to raise the protein level from 14 to 17 percent. Both diets contained 2720 Kcal metabolizable energy per kilogramme.

The results of the experiment showed that pullets had similar performance in regard to the rate of egg production, egg weight, total egg mass, grams feed per gram egg and change in body weight, under both levels of dietary protein in spring. Similar response has been obtained in summer with the exception that pullets of both breeds lost significantly more weight with 14% as compared to 17% dietary protein.

## INTRODUCTION

Reviewing the literature demonstrates that the levels of protein which are recommended by various investigators for laying hens for optimum egg production are as numerous and variable as the number of experiments which have been conducted on this subject. Sharp and Morris (7) showed that the diet of laying hens should contain more than 16.5% protein when the metabolizable energy (ME) of the diet is about 2765 Kcal/kg. In contrast Smith and Lewis (8) demonstrated that for obtaining optimum egg production the level of protein in the diet of laying hens could be decreased to 12.5% even when ME of the diet was as high as 3050 Kcal/kg. The National Research Council (4) suggested that laying hens require 15% protein when the diet contains 2850 Kcal ME/kg. The existing variation in the recommended level of protein for laying hens obviously is due to several factors including the energy content of the diet, stage of egg production, rate of egg production, environmental temperature, strains, egg weight, and body weight gain (Scott *et al.* 6; Balloun and Speers, 1).

The present experiment was conducted for the purpose of studying the effect of two levels of dietary protein in performance of two breeds of laying hens under the environmental condition of Shiraz.

## MATERIALS AND METHODS

Three hundred Leghorn and 300 New Hampshire day-old chicks were obtained in late September, 1967 and were raised on litter. In late March 1968, sixty Leghorn and

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60 New Hampshire pullets were selected randomly from the flock and were housed in individual cages. The average weights of the pullets in the beginning of the experiment were 1.70 and 2.15 kg for Leghorn and New Hampshire, respectively. Two isocaloric mash diets (Table 1) containing 14 and 17% protein were compared in this experiment. The level of protein was raised from 14 to 17% by substituting cotton seed meal and fish meal for barley. This manipulation did not change the energy content of the diets and kept them constant at 2720 Kcal ME/kg. Proximate analyses were conducted on all the components of the diets as outlined by Horwitz (3). The obtained data were used for calculation of the ME of the ingredients using the percentage multiplier method suggested by Titus (10). The results are shown in Table 2.

The experiment was conducted as a 2 X 2 factorial, using four treatment combinations (two levels of protein and two breeds) in a completely randomized design, with six replications (five pullets per replicate). The pullets were fed the experimental diets for a period of six months in spring and summer. The average of maximum and minimum temperatures (recorded outside the building) in the spring period were 30 and 6C, respectively, while for the summer period they were 37 and 14C, respectively. During the periods of the experiment, the egg production and individual egg weights were recorded. The amount of feed consumed by each group was determined at two-week intervals.

The experimental data were analyzed statistically by the analysis of variance (9) and the means were compared by Duncan's multiple range test (2).

## RESULTS AND DISCUSSION

The results of the experiment are shown in Table 3. In order to eliminate the influence of season and stage of production of dietary treatments, the experimental period was divided into two periods of 3 months each (spring and summer), and the obtained data for each period were anlayzed separately.

The rate of egg production, egg weight, total egg mass, grams feed per gram egg and change in body weight were not significantly different ($p < 0.05$) when the two levels of dietary protein were compared in each breed in spring. Similar results were obtained in summer except that Leghorn and New Hampshire pullets on the 14% protein diet lost significantly more weight than the respective breeds on the 17% protein diet ($p < 0.05$). Reid *et al.* (5) showed that layer usually lose weight in warm weather. They have attributed this loss of weight to the insufficiency of protein intake as a result of lower feed intake in warm weather. The data (Table 4) show that the pullets fed 14% protein diet in summer received less protein per day than the similar diet in spring or the 17% protein diet in summer. It is possible to attribute the higher loss in body weight with 14% protein diet in summer to inadequate protein intake.

Irrespective of the breeds and the levels of protein, pullets had a lower rate of egg production and heavier egg weight in summer than spring. These responses could be due to the combination effect of increased environmental temperature and age of birds.

Table 1: Composition of the Experimental Diets.

| Ingredients | 14% Protein diet | 17% Protein diet |
|---|---|---|
| | % | % |
| Ground yellow corn | 28.0 | 28.0 |
| Ground wheat | 34.0 | 34.0 |
| Ground barley | 14.8 | 7.8 |
| Fish meal (69% protein) | 2.0 | 3.8 |
| Dried Skim milk | 1.0 | 1.0 |
| Cotton seed meal (48% protein) | 7.0 | 12.4 |
| Alfalfa leaf meal, sun cured | 2.0 | 2.0 |
| Bone meal | 2.1 | 2.3 |
| Oyster shell | 8.0 | 8.0 |
| Salt | 0.5 | 0.5 |
| Vitamins and minerals premix[2] | 0.4 | 0.4 |
| Crude protein (N% X 6.25) | 14.0 | 17.0 |
| ME (Kcal/kg)[3] | 2720.0 | 2720.0 |

2. Bi-con Fort (Pfizer Co.). This supplement furnished the following per kg of the diets; vitamin A, 7200 I.U., vitamin D3, 1600 ICU. vitamin E, 1.6 mg; riboflavin, 4 mg; niacin, 20 mg; calcium pantothenate, 8 mg; vitamin K, 2 mg; vitamin $B_{12}$, 8 mg; choline chloride, 160 mg; terramycin, 24 mg; manganase, 40 mg; iron 12 mg; copper, 1.2 mg; cobolt, 0.32 mg; zinc, 20 mg; and iodine, 0.96 mg.

3. The ME of the ingredients were calculated by Titus's method (10), using percentage multiplier after proximate analyses of the ingredients.

Table 2. Proximate analyses and calculated metabolizable energy of feed ingredients.

| Ingredients | Proximate Analyses[4] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Moisture % | Ash % | Protein (N x 6.25) % | Ether Extract % | Fiber % | N.F.E. % | ME[5] Kcal/kg |
| Ground corn | 10.83 | 1.40 | 10.87 | 4.47 | 1.89 | 70.54 | 3454 |
| Ground wheat | 11.62 | 1.79 | 11.20 | 1.64 | 2.32 | 71.43 | 3065 |
| Ground barley | 11.22 | 2.50 | 10.19 | 2.59 | 6.32 | 67.18 | 2776 |
| Cottonseed meal | 7.41 | 6.35 | 48.94 | 4.28 | 10.77 | 22.25 | 2578 |
| Fish meal | 7.79 | 16.48 | 69.13 | 5.30 | 0.20 | 0.92 | 3087 |
| Dried skim milk | 8.04 | 8.50 | 32.73 | 0.30 | 0.15 | 50.28 | 2767 |
| Alfalfa leaf meal sun-cured | 8.80 | 10.50 | 25.23 | 2.90 | 11.95 | 40.57 | 1503 |

4. The figure are the mean of three analyses.

5. The ME of all the ingredients were calculated by using Titus's percentage multiplier (10).

Table 3. Mean Performance of Leghorn and New Hampshire laying Hens, fed the two levels of dietary proteins.[6]

| Treatments | Breed | Leghorn | | New Hampshire | | Standard error |
|---|---|---|---|---|---|---|
| | Level of protein | 17% | 14% | 17% | 14% | |
| Egg production (%) | | | | | | |
| Spring | | $79^{ab}$ | $83^{a}$ | $76^{b}$ | $80^{ab}$ | ± 2.4 |
| Summer | | $67^{ac}$ | $71^{a}$ | $61^{b}$ | $66^{bc}$ | ± 2.9 |
| Egg weight (gm ) | | | | | | |
| Spring | | $49.9^{ac}$ | $48.6^{a}$ | $51.2^{b}$ | $51.0^{bc}$ | ± 0.75 |
| Summer | | $53.3^{a}$ | $52.2^{a}$ | $54.6^{b}$ | $54.9^{b}$ | ± 0.77 |
| Total egg mass (gm ) | | | | | | |
| Spring | | $3587^{a}$ | $3705^{a}$ | $3420^{a}$ | $3737^{a}$ | ± 115 |
| Summer | | $3252^{a}$ | $3367^{a}$ | $3034^{a}$ | $3306^{a}$ | ± 55 |
| Grams feed/gram egg | | | | | | |
| Spring | | $2.98^{ac}$ | $2.87^{a}$ | $3.23^{b}$ | $3.07^{bc}$ | ± 0.108 |
| Summer | | $2.96^{a}$ | $2.96^{a}$ | $3.29^{b}$ | $3.21^{b}$ | ± 0.099 |
| Change in body weight (gm ) | | | | | | |
| Spring | | $+116^{a}$ | $+105^{a}$ | $+108^{a}$ | $+81^{a}$ | ± 31.8 |
| Summer | | $+12^{a}$ | $-18^{b}$ | $-33^{b}$ | $-94^{c}$ | ± 20.4 |

6. Means followed by the same letter in each row are not significantly different at the 5% level; determined by Duncan's Multiple Range Test (2).

Table 4. Feed and protein consumption of laying hens fed the experimental diets.

| Treatment | | Daily feed consumption (g/hen) | | Daily Protein consumption (g/hen) | |
|---|---|---|---|---|---|
| Breeds | Protein % | Spring | Summer | Spring | Summer |
| Leghorn | 17 | 113.0[a7] | 105.2a | 19.2a | 19.9a |
| Leghorn | 14 | 112.7a | 108.5ac | 15.8b | 15.2b |
| New Hampshire | 17 | 120.3b | 110.3bc | 20.5c | 18.8c |
| New Hampshire | 14 | 122.2b | 114.6b | 17.1d | 16.0b |
| Standard error | | ±3.25 | ±2.92 | ±0.50 | ±0.45 |

7. Means followed by the same letter in each column are not significantly different at the 5% level; determined by Duncan's Multiple Range Test (2).

## ACKNOWLEDGEMENTS

The authors wish to thank Dr. K. Keshavarz for reviewing the paper and Mr. M.S. Mostaffavi for experimental assistance.

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