

Production Response of Athulya Layer Chicken to Dietary Energy Concentration and Feed Particle Size

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Abstract

An experiment was carried out in 450 Athulya layer hens (commercial strain cross of Single Combed White Leghorn) from 17 to 64 weeks of age to evaluate the influence of metabolizable energy (ME) levels (2200, 2400 and 2600 kcal/kg) and feed particle size (3.0, 5.0 and 7.0 mm) on production performance and economics in a 3x3 factorial design. All experimental diets were identical in calorie protein ratio. The results revealed statistically similar housed egg production and egg weight were observed among treatments. The daily feed intake and feed conversion ratio (FCR) value was significantly ($p < 0.001$) lower in birds fed diet with 2600 kcal/kg ME than in birds fed diet with lower ME levels (2400 and 2200 kcal/kg). Particle size did not influence feed intake and FCR. The body weight and body weight gain at 40 and 64 weeks of age was significantly ($p < 0.05$) higher in 2600 kcal/kg ME group than in lower ME levels (2400 and 2200 kcal/kg) group. The different particle size did not affect body weight and body weight gain at 40 and 64 weeks of age. Livability of birds was not influenced by either dietary ME levels or particle size. The highest return over feed cost per egg was recorded in birds fed 2200 kcal/kg ME diet with particle size of 7.0 mm. Thus, the results of present study indicated that diet containing ME level of 2200 kcal/kg with 15.22 per cent CP and particle size of 7.0 mm was most suitable for Athulya layer chicken from 17 to 64 weeks of age.

Keywords: Athulya, Egg Production, Feed Intake, Metabolize Energy, Particle Size

Introduction

The Athulya hybrid layer is a Single Combed White Leghorn strain developed at All India Coordinated Research Project on Poultry Breeding, College of Veterinary and Animal Sciences, Mannuthy which produces 310 eggs in 72 weeks of age with average egg weight of 53.0 g (AICRP, 2014). The response of these birds to energy concentration of diet is not well documented. With low energy diet, energy consumption might be insufficient to sustain optimum egg output. High energy diet, on the other hand, might lead to excessive energy intakes, especially in heavy strains having high inherent feed intake capacity. The response to energy concentration of diet is thus strain dependent. Diet particle size is another important factor influencing nutrients intake of birds. The laying hens are invariably fed *ad libitum* on mash diets with medium to coarse grain particle. Laying hens fed mash diet has preference for medium and coarse particle (Portella *et al.*, 1988). The preferential eating of grains may lead to over consumption of energy and under consumption of other essential nutrients. Commercial layer strains vary in preference to diet particle size also. The responses of Athulya hybrid layer to changes in ME level and particle size of diet are not well documented. Hence, the present study was conducted to evaluate response of Athulya layer chicken to reduced levels of dietary ME and particle size.

Materials and Method

The experiment was carried out in 3x3 factorial design with four hundred and fifty Athulya pullets of 16 weeks age. The metabolizable energy level and particle size of diets formed the experimental factors and each factor consisted of three levels as following: ME: 2600, 2400 and 2200 kcal/kg of diet and particle size: 3.0, 5.0, 7.0 mm sieve size, respectively. Thus, in total, there were nine treatment combinations and each treatment was replicated five times and each replicate constituted 10 birds. The experimental diets with high ME (2600 kcal/kg) level were formulated as per BIS, 1992 specifications. The diets with lower ME levels (2400, 2200 kcal/kg) were formulated maintaining identical calorie protein ratio as that of high ME (2600 kcal/kg) diet. The particle size reduction of experimental diets was achieved by using a hammer mill with sieves of 3-, 5- and 7-mm openings. Standard management procedures were adopted throughout the experimental period. The major ingredients (maize and soy bean meal) were milled in hammer mill.

Table 1: Per cent ingredient composition of experimental diets

Ingredients	2600 ME kcal/kg	2400 ME kcal/kg	2200 ME kcal/kg
Maize	57	46	38.5
Soya Meal	30	22.5	17
Deoiled rice bran	3	18.5	18.5
Wheat bran		3	16
Dicalcium phosphate	1.5	1.5	1.5
Calcite	8	8	8
Salt	0.5	0.5	0.5
Feed supplements (g per 100kg feed)			
Merivite ¹	0.012	0.012	0.012
Meriplex ²	0.012	0.012	0.012
DL-methionine ³	0.1	0.1	0.1
Ultra TM ⁴	0.1	0.1	0.1
Tefroli ⁵	0.025	0.025	0.025
Choline chloride ⁶	0.2	0.2	0.2
UTPP ⁷	0.1	0.1	0.1

Merivite¹: A+B₂+D₃+K (Wockhardt Ltd., Mumbai) : Each gram contains : Vitamin A: 82,500 IU, Vitamin B₂:52 mg, Vitamin D₃:12,000 IU, Vitamin K: 10mg, Calcium: 166 mg, Phosphate: 395 mg. (Vetroquinol India Animal Health Pvt.Ltd. Mumbai.); Meriplex² : Each gram contains: Vitamin B₁: 8mg, Vitamin B₆: 16mg, Vitamin B₁₂: 80mcg, Vitamin E: 80mg, Niacin: 120mg, Folic acid: 8mg, Calcium pantothenate : 80mg, Calcium: 86mg. (Vetroquinol India Animal Health Pvt.Ltd. Mumbai.); DL-methionine³ : 99 per cent, Promois, Feedgrade; Ultra TM⁴: Each gram contains: Manganese: 54mg, Zinc: 52 mg, Iron: 20mg, Copper: 2mg, Iodine: 2mg and Cobalt: 1mg; Tefroli⁵: Liver tonic powder. Dr. Herbs India, Vellore, Tamil Nadu; Choline chloride⁶: NB group Co-Ltd. Mumbai; UTPP⁷: Aluminosilicates, Propionates, Formates and Acetates (Bio- Tech, Bangalore)

Other ingredients were already in milled forms at the point of purchase. The various ingredients were individually weighed out in their milled form into feed mixer and mixed to get the experimental diet. The ingredient composition of experimental diet is given in Table 1. The duration of experiment was from 17 to 64 weeks of age. Data on various production traits were recorded.

Statistical Analysis

Data were analyzed with the General Linear Model (GLM) procedure of SPSS 20 with ME levels and sieve size as main effects. Probability at 5 per cent level was taken to indicate statistical significance using Duncan Multiple Range Test (1955).

Result and Discussion

Production performance of Athulya hen as influenced by diet energy level and particle size is given in Table 2. The effect of dietary ME level and particle size was not significant for hen housed egg production. The lack of significant difference in egg production between birds fed diets with the three ME levels could be explained by the fact that Athulya layer birds were able to adjust feed intake to maintain optimum nutrient intake for egg production within the range of 2200 to 2600 dietary ME levels maintaining the C:P same. Thus, the present result indicated that Athulya layer chicken could tolerate dietary ME level as low as 2200 kcal/kg to support optimum egg production up to 64 weeks of age. Leeson *et al.* (2001) also reported similar results that diets with a ME as low as 2465 kcal/kg and CP as low as 15.2 per cent could be adequate to support a full cycle of production in Shaver White hens. Very few reports are available on effect of ME level of diet as low as 2200 kcal/kg on egg production performance of commercial layer chicken. The results also indicated that fine (3 mm) or medium (5mm) grinding of feed as in the present study had no positive effect on egg production. This agrees with, Mac Issac and Anderson (2007) who reported that grain texture (5 and 7 mm) did not influence egg production of White Leghorn hens up to 64 weeks of age. The significantly ($p < 0.001$) higher feed intake in birds fed diet containing low ME levels (2200 and 2400 kcal/kg) was evident. However, these birds were able to consume sufficient nutrients as evidenced by optimum egg production. Increased feed intake with decreasing dietary concentrations of ME has been observed in reports by Sahasani *et al.* (2013) and Bobeck *et al.* (2014). However, it was observed that as ME level of diet reduced from 2600 to 2200 kcal/kg, laying hens did not fully compensate their feed intake, resulting in a proportionally reduced ME intake especially during early stages of the lay cycle and summer season.

It appeared that Athulya layer chicken overconsumed energy at dietary ME levels of 2600 kcal/kg and under consumed energy at dietary ME level of 2200 kcal/kg. This is in agreement with findings of Persio *et al.* (2010) and Qaisrani *et al.* (2013) who reported that commercial laying hen has a limited capability to increase its feed consumption if subjected to a dietary dilution. However, ME intake of birds fed on diet with 2200 kcal/kg was sufficient to support optimum egg production. The reduced particle size (3 and 5 mm) used in the present study was not effective to restrict overconsumption of feed. Similarly, Mac Issac and Anderson (2007) did not observe any significant difference in feed intake between birds fed on diets containing coarse (7 mm) and fine particle size (5 mm) in White Leghorn hens from 20 to 64 weeks of age. The significant ($p < 0.001$) difference observed in FCR value of birds between different dietary groups was due to increased feed intake in groups fed diet with lower ME levels. Similar to present finding, Persio *et al.* (2010) reported higher FCR value in birds fed lower density diet in Hy-Line W-36 laying hens.

Even though not significantly different, FCR value was lowest in birds fed diet with fine particles (3 mm) which might be due to the fact that reduction in particle size increases the surface area for enzymatic activity thereby result in higher digestibility and improved bird performance. In agreement with Mac Issac and Anderson (2007) who reported decrease in FCR value by 15.3 per cent in diet finely ground grains (5 mm) than coarsely ground grains (7 mm) in White Leghorn layer chicken. As dietary ME concentration reduced, egg size decreased, but the effect was significant only at initial periods. The reduced egg size noticed during early stages of the lay cycle of Athulya layer chicken might be due to lower ME intake by birds fed diet containing low ME level diet. Similarly, Leeson *et al.* (2001) and Bobeck *et al.* (2014) reported significant difference in egg size due to diet dilution only at isolated measurement times.

Table 2: Production performance of Athulya hen influenced by diet energy level and particle size

Factor	Hen housed Egg production %	Feed intake/bird/day(g)	ME intake/bird/day	FCR	28-week egg weight (g)	40week egg weight (g)	64weeks egg weight (g)	40-week Body weight (g)	64-week body weight (g)	Livability %
2200	74.85±1.4	130.69 ^c ±0.52	287.52 ^a ±1.15	2.03 ^b ±0.03	49.45 ^a ±0.32	54.32±0.34	55.38±0.4	1444.24 ^a ±10.61	1510.52 ^a ±15.59	92.59±2.34
2400	73.48±1.44	127.03 ^b ±0.31	304.88 ^b ±0.74	1.97 ^b ±0.02	50.02 ^{ab} ±0.35	54.97±0.35	56.41±0.5	1502.98 ^b ±13.45	1585.60 ^b ±18.65	84.44±3.03
2600	74.04±1.82	119.40 ^a ±0.32	310.45 ^c ±0.82	1.81 ^a ±0.03	50.92 ^b ±0.32	54.33±0.34	56.04±0.42	1589.33 ^c ±16.70	1788.03 ^c ±23.58	86.67±3.63
3.0	76.32±1.3	125.28±1.39	299.89±2.74	1.91±0.04	50.02±0.30	54.32±0.34	55.77±0.46	1502.60±13.78	1649.63±23.15	88.89±2.66
5.0	72.4±1.66	125.57±1.26	300.65±2.87	1.96±0.04	50.19±0.35	54.13±0.33	56.61±0.48	1507.39±14.21	1628.74±19.65	88.89±2.87
7.0	73.66±1.68	126.27±1.29	302.3±2.65	1.94±0.03	50.25±0.36±	55.17±0.36	55.46±0.39	1524.72±15.78	1596.79±23.16	85.93±3.83
E	0.825	0	0	0	0.006	0.316	0.242	0	0	0.197
P	0.194	0.21	0.188	0.376	0.824	0.78	0.171	0.481	0.199	0.757
ExP	0.29	0.772	0.74	0.583	0.398	0.97	0.413	0.99	0.788	0.936

The present study indicated that fine (3 mm) or medium (5 mm) grinding of feed was not effective to improve the egg weight. Similarly, Singh *et al.* (2014) did not observe any significant difference in egg weight between birds fed on diets containing different particle size.

In the present study higher levels of ME (2600 and 2400 kcal/kg) used resulted in fat deposition and subsequent body weight gain over the experimental period. The body weight gain increased with increasing dietary ME level from 2200 to 2600 kcal/kg, due to increased intake of ME and CP. Increased bodyweight with increasing dietary ME level has been previously reported by Rao *et al.* (2013) and Sahasnani *et al.* (2013). The fine (3 mm) or medium (5 mm) particle sizes of feed in the present study was not effective to prevent overconsumption of energy subsequently obesity in Athulya layer chicken. Similar to the present findings, Safaa *et al.* (2009) and Singh *et al.* (2014) did not observe any significant difference in body weight gain between birds fed on diets containing different particle size. The overall livability was not affected by dietary energy level indicating that the average daily intake of various nutrients in all dietary ME levels appears to be adequate for White Leghorn layers to sustain optimum health. Thus, the present result indicated that Athulya layer chicken could tolerate dietary ME level as low as 2200 kcal/kg to support optimum health up to 64 weeks of age. The result of the present study agrees with Gunawardana *et al.* (2008) who reported that there was no significant effect of dietary energy on mortality of birds. The fine (3 mm) or medium (5 mm) grinding of feed did not affect livability of Athulya layer chicken. In agreement with present findings, Mac Issac and Anderson (2007) and Safaa *et al.* (2009) did not observe any significant difference in per cent livability between birds fed on diets containing different particle size.

Conclusion

The present study indicated that diet containing ME level of 2200 kcal/kg with 15.22 per cent CP and particle size of 7.0 mm was most suitable optimum performance for Athulya layer chicken from 17 to 64 weeks of age.

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Conflict of Interests

There is no conflict of interest.

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