Performance and Egg Quality Characteristics of Layers Fed Diets with Varied Energy Levels

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ABSTRACT

This study was carried out to determine the effect of feeding varied energy level diets with balanced crude protein on the performance and egg quality characteristics of laying birds. One thousand two hundred (1200) Isa-Brown laying birds were allocated to four different diets in a completely randomized design. Diets 1, 2, 3, and 4 had 2500kcal/kg, 2600kcal/kg, and 2700kcal/kg and 2650kcal/kg energy respectively, with the study lasting 10 weeks. Data were collected on feed intake, egg production, egg weight, length, and width, yolk depth, length, and width, albumen width, length and depth, shell thickness and performance of laying birds fed the different diets. Results indicate that laying birds fed with 2,500kcal/kg performed better. The feed intake was highest and egg production also was highest without compromising the internal and external egg qualities. This gives an indication that adequate feed intake of balanced diet with moderate energy to a large extent will enhance better performance.

Keywords: Energy levels, Egg quality, Layers' performance

INTRODUCTION

Poultry production has been retarded by high cost of feeding ranging between 60-70% of the cost of production. Adeyemo *et al* (2007). Tewe and Egbunike (1992) reported that the energy content constitutes between 45-60% of finished feed for monogastric livestock. Carbohydrate feeds are basically the major energy sources in livestock feeds. Feeds that are best sources of energy for poultry birds contain carbohydrates that are readily digested such as sucrose, maltose, and starch which are needed for body maintenance and production Buttery *et al.* (2006). Dietary energy levels usually determine the levels of other nutrients including proteins and amino acids. Leeson and Summers (1997) recommended that the dietary energy density of pullets should be 3000 kcal ME.

Scott *et al.* (1982) reported that energy intake has virtually no effect on egg size and at low protein intake, increasing energy may result in reduced egg size. Therefore, egg mass apparently is most responsive to energy than protein intake. Also as energy intake increases, there is a drastic increase in egg production. In general, poultry birds adjust their feed in take to satisfy their energy requirement which vary with body size, environmental temperature and rate of lay. Laying birds should be given feeds with appropriate energy level so as to prevent them from utilizing energy from sources like their body protein causing a reduced production level and weight loss of the birds. This occurs as a result of compromise in its muscle mass due to energy shortage. While these relationships are commonly understood in commercial feed formulation today, it would be highly desirable to verify the rather old results with modern hybrid layers to quantify the effects and fine-tune recommendations (Jeroch, 2011).

Poultry egg is an excellent food that contains 12-13% of the crude protein of an egg weight (Lamberson and Firman, 2002). According to Lamberson and Firman (2002), egg quality relates generally to various standard imposed on eggs or all characteristics of an egg that affects its acceptability to a consumer. It is assumed that an egg with good quality should not float in water because it has a density that is slightly higher than that of water. The standards imposed on egg characteristics can be divided mainly into those used in the determination of external and internal qualities. Generally exterior and interior egg quality standards are based on soundness, texture, colour, shape, relative viscosity of the albumen, shape and firmness of the yolk and freedom from foreign matter in the albumen.

The objective of this study was to determine the optimal energy level that is best for modern hybrid layers production in the tropics.

MATERIALS AND METHODS

The experiment was carried out at the Zartech Research Pen of the poultry section at the Teaching and Research Farm, University of Ibadan. One thousand two hundred (1200) Isa-Brown layers 30 weeks of age were used for the experiment. The birds were randomly allocated to four diets having varied energy levels with 3 replicates per diet in a completely randomized design. The farm environment was constantly cleared and kept clean, feeds and water was constantly available to the birds and the litter was constantly packed. The birds were fed *ad* *libitum*and eggs were picked twice per day. The birds were fed the varied energy level feed for 3weeks to acclimatize with the change in the feeding regime. The gross compositions of the diets are presented in Table 1.

Table 1
Gross composition of experimental diets with varying energy levels fed to layers.

	Treatments			
Ingredients (%)	**1**	**2**	**3**	**4**
Maize	39.95	49.44	51.93	49.76
Soya bean meal	12.98	12.98	12.98	12.98
Groundnut cake	9.99	11.82	11.98	11.75
Wheat bran	6.82	5.66	2.00	4.96
Corn bran	9.99	9.86	7.82	5.15
Palm kernel cake	8.99	3.00	1.00	3.12
Oyster shell	9.49	9.49	9.49	9.49
Bone meal	2.00	2.00	2.00	2.00
Methionine	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15
Salt	0.25	0.25	0.25	0.25
Layers premix	0.25	0.25	0.25	0.25
Crude Protein (%)	16.50	16.50	16.50	16.50
Metabolizable Energy (Kcal/kg)	2500	2600	2700	2650

Data collection

The feed consumed by each replicates were measured weekly by dividing the total feed intake by the number of birds per replicate. Egg collection was done twice a day in the morning and evening. The numbers of eggs produced were recorded on a daily basis to evaluate the performance of the birds and monitor increase or decrease in percentage production.

Egg Quality

Egg-quality measurements were made on all eggs, freshly collected, laid on two consecutive days. Egg quality was based on determination of external and internal indices, and egg components. The external indices include egg-shape index and shell thickness, and those of interior quality were albumen index, haugh unit score and yolk index. Collected eggs were weighed individually and their widths and lengths were measured. Then, they were broken onto a smooth level surface and the height of albumen was determined, away from the chalazae, at the two highest points on opposite sides of the yolk, using a standard tripod micrometer. The average of the two measurements of thick albumen height together with egg weights were used to compute the Haugh unit score for each individual egg as cited by Larbier and Leclercq (1994), as follows: Haugh units = 100log $(H + 7.57 - 1.7w^{0.37})$

where H is albumen height in millimetres (mm) and W is egg weight (g).

Yolk height was also determined using the same micrometer, while yolk diameter was measured to the nearest 0.1 mm using a steel Vernier caliper. Yolk index was calculated as yolk height × 100 divided by yolk diameter. Egg-shape index was measured as egg width × 100 di-vided by egg length. Albumen index was calculated as: [(albumen height (mm)/average of albumen length (mm) and albumen width (mm)] × 100. Shell thickness was measured using a micrometer screw gauge. Measurements were made at two corresponding positions on the equator of the eggshell and the average was recorded to the nearest 0.001 mm

All the data collected were subjected to analysis of variance. The treatment means were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Results presented in Table 2 show that there were no significant differences ($p>0.05$) observed for all parameters assessed except for yolk length ($p<0.05$). Numerical indices however showed that hen-day production was highest at 2500kcal/kg, while the lowest value was at 2700kcla/kg. This same trend was also observed for feed intake and egg weights as well as yolk length ($p<0.05$). Yolk weights and albumen weights were however lowest at 2500kcal/kg and highest at 2650kcal respectively. Feed intake is a major determination of the production rate and this becomes very obvious in the egg production result obtained as birds fed 2,500kcal/kg had the highest egg production and they also consumed the most feed. Since the birds were all subjected to the same environmental conditions, the disparity in feed intake cannot be attributed to environmental factors but to the energy contents of the different diets because birds fed the highest energy ate the least feed. Birds eat to meet their energy requirement and once there energy requirement is met, they stop eating until the feed they have consumed is used up. Feed intake is directly proportional to egg production and the higher the energy level the lower the intake (Adeyemo and Longe, 2008). This makes energy level inversely proportional to feed intake.

As reported by Pardio *et al.* (2005), energy inclusion levels have little or no significant influence on egg shell thickness. Also, Wu *et al* (2007) reported that nutrient density in diets do not have any significant difference on shell thickness except the amino acids, calcium and phosphorus inclusion levels in the diet is altered. Therefore, the result obtained for shell thickness could be as a result of environmental factors which agrees with Oluyemi and Roberts (1979) that the average shell thickness of egg laid by birds during the first few weeks of lay is 0.34mm but is usually thinner in the tropics than in the temperate, where the shell thickness is reduced. Samli *et al* (2005) reported that increased laying hen productivity leads to reduction in egg shell quality and an improvement of albumen quality which agrees with what Oluyemi and Roberts (1979) reported, that egg production increases with the age of the birds and later drops gradually from peak to about 65% before the birds reaches moulting.

Table 2
Effect of varying energy levels on performance and egg quality parameters of laying birds

	Treatments				
Parameters	1	2	3	4	SEM
Hen-day Egg Production	71.20	53.60	50.10	61.30	4.12
Feed Intake(g)	63.48	58.20	53.83	60.35	1.53
Egg weight (g)	61.35	60.49	59.95	61.22	1.11
Specific gravity (ml)	59.43	59.81	59.52	60.64	1.61
Egg length (cm)	5.34	5.35	5.27	5.31	0.24
Egg width (cm)	4.37	4.32	4.34	4.36	0.04
Shell thickness (mm)	0.31	0.31	0.30	0.33	0.02
Yolk length (cm)	3.63[a]	3.58[ab]	3.53[b]	3.61[ab]	0.04
Yolk width (cm)	3.46	3.40	3.40	3.43	0.04
Yolk depth (cm)	1.64	1.60	1.61	1.64	0.05
Albumen length (cm)	8.27	8.02	7.86	8.11	0.87
Albumen width (cm)	6.39	6.27	6.09	6.14	0.22
Albumen depth (cm)	1.50	1.39	1.40	1.37	0.57
Yolk weight (g)	14.54	14.71	15.06	15.15	0.95
Albumen weight (g)	19.22	19.50	19.66	20.33	2.74

SEM: Standard Error of Mean

CONCLUSION

The result of this work showed that varying levels of energy in diets with constant crude protein at the required level had no significant effect on the performance and egg qualities of Isa brown layers. Numerical values however reveal 2500kcal was optimal for laying birds in the tropics like Nigeria.

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