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PERFORMANCE OF LAYING HENS FED DIETS CONTAINING VARYING ENERGY LEVELS DURING THE LATE LAYING PHASE

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Abstract: *An experiment was conducted to determine the effect of feeding different energy levels on the performance of laying birds during the late laying phase. A total of 90 birds were randomly divided into three treatment groups with 30 birds / treatment. Each treatment was sub-divided into five replicates with six birds per replicate. Three experimental diets were prepared containing 2,800 (T1), 2,500 (T2) and 2,300 (T3) kcal/kg of ME. Each experimental diet was fed to one of the treatments for a period of 11 weeks (i.e. from the 129th to the 139nt weeks of age of the birds). Results showed that feed intake (g/b/d) increased significantly (P<0.05) from 118.8 for T1 to 135.5 for T3. However, daily egg production was statistically similar between the treatments, even though a slightly higher value was obtained for T3 (78.4, 76.6 and 79.3% for T1, T2 and T3, respectively). FCR and egg weight were also similar between the treatments. Cost of feed (₦/kg) decreased by 17.1% from T1 to T3, but cost of feed consumed (₦/b/d) decreased only by 4.9%. Consequently, cost of feed /egg was slightly lower for T3 (₦18.1) compared to T1 (₦19.5) and T2 (20.1) (P>0.05). These results tend to indicate better economic benefit of feeding the lowest energy density diet (T3).*

Key words: *laying hen, laying phase, energy levels.*

I. INTRODUCTION

Poultry diets are composed primarily of a mixture of several feedstuffs including energy sources (such as cereal grains), protein sources (such as oil seed cakes and meals), and other sources of minerals (e.g. limestone and bone meal) and vitamins (vitamins and mineral premixes). These feedstuffs, together with water, provide the nutrients that are essential for the bird's growth, reproduction, and health.

The energy necessary for maintaining the bird's general metabolism and for producing meat and eggs is provided by the energy-yielding dietary components - primarily carbohydrates and fats, but also proteins. Poultry diets can also include certain constituents not classified as nutrients, such as xanthophyll's (the pigment that imparts a characteristic color to poultry products); "growth factors" that promote growth; and antimicrobial agents which may improve growth and efficiency of feed utilization.

The first monograph with recommended energy and nutrients requirements of poultry was published in 1944 by the US National Research Council (NRC). These standards were based on the substantial knowledge available at that time in North America on energy and nutrient requirements of laying hens and other poultry, as well as contents of energy and nutrients in feedstuffs used in poultry diets. The tables were updated in a subsequent edition (9th edition) published in 1994. Europe followed in 1963, with recommendations for energy and nutrient requirements, published by the Agricultural Research Council (ARC) in the UK. Since these recommendations have been established largely in the temperate regions of the world, it becomes imperative to make efforts to establish appropriate recommendations in the tropics where the climatic conditions are different. It is well known that birds generally eat to satisfy their energy requirements. Thus, under high ambient temperatures feed intake is reduced, mainly due to

the lowered requirement of energy to maintain body temperature. The reduction in feed intake thus translates to reduced consumption of all nutrients, which translates to lowered performance.

II. MATERIALS AND METHODS

LOCATION OF EXPERIMENT

This study was conducted at the Teaching and Research Unit at the Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University Sokoto located at Veterinary Clinic, Aliyu Jodi Road, Sokoto. Sokoto is located in the Sudan Savannah Zone in the extreme North Western part of Nigeria, and lies between latitudes 12^0Nto 13^0N and longitudes 40 and 60°E (Mamman *et al.*, 2000). Sokoto has low humidity and high solar radiation. Maximum and minimum temperature of 42^0C and 13^0C was reported in May and January respectively.

Experimental Procedure:

A total of 90 birds were used in the experiment. They were randomly divided into three treatment groups with 30 birds / treatment. Each treatment contained five replicates with six birds per replicate. Three experimental diets were prepared containing 2,800 (T1), 2,500 (T2) and 2,300 (T3) kcal/kg of ME. The composition of ingredients and nutrients in the experimental diets are shown in table 1.

The birds were housed in battery cages with one bird per cage. Each experimental diet was fed to one of the treatments for a period of 11 weeks (i.e. from the 129th to the 139th weeks of age of the birds). Feed and water were offered *ad libitum*. Feed intake and egg weight were monitored weekly, while egg production was monitored daily.

Table (1): Composition of ingredients and nutrients in the experimental diets

	Treatments		
	T1	T2	T3
Composition of ingredients (%)			
Maize	55.55	39.30	28.45
Soybean meal	23.10	21.00	19.50
Wheat offal	9.45	27.70	40.05
Limestone	8.80	9.00	9.00
Bone meal	2.40	2.40	2.40
Salt (NaCl)	0.30	0.30	0.30
Premix	0.25	0.25	0.25
Methionine	0.11	0.11	0.09
	100	100	100
Total			
Calculated metabolisable energy (ME) (kcal/kg) and nutrients composition (%)			
ME	2,800	2,500	2,300
Protein	17.0	17.1	17.4
Lysine	0.87	0.94	0.98
Methionine	0.37	0.35	0.35
Cysteine	0.28	0.30	0.31
Methionine + Cysteine	0.65	0.65	0.66

Isoleucine	0.66	0.66	0.65
Calcium	4.01	4.09	4.10
Available phosphorus	0.41	0.41	0.41

III. DATA ANALYSIS

The data collected was subjected to analysis of variance (AVOVA) using the STAT VIEW (SAS, 1998) Statistical package.

IV. RESULTS AND DISCUSSION

Feed intake increased with decreasing energy levels of the diets throughout the experimental period (Table 2) For the whole period, feed intake increased significantly from 118.7g/b/d for T1 to 135.5g/b/d for T3

Table (2): Daily feed intake of the experimental birds.

Age (weeks)	T1 (2,800)	T2 (2,500)	T3 (2,300)
129	119.0	122.7	131.0
130	126.2	130.0	130.5
131	119.1	138.1	134.8
132	120.0	127.1	148.6
133	119.0	129.1	145.7
134	120.0	127.6	132.9
135	117.6	123.8	124.8
136	120.0	126.2	132.9
137	109.1	122.4	132.4
138	119.5	131.0	138.6
139	116.7	131.4	138.6
Mean	**118.7**	**128.1**	**135.5**

[a, b, c]Means in the same raw followed by different superscripts are significantly different (P<0.05).

It has been well established that birds eat primarily to satisfy their energy requirements. Thus, it is expected that the higher the dietary energy density, the lower the feed intake. This trend has been observed by many workers (Hills and Dansky, 1954; Hill, 1956; Balnave and Robinson, 2000).

Egg production was statistically similar between the treatments, even though the mean egg production was slightly higher for T3 (79.4%) compared to the values recorded for T1 (78.4%) and T2 (76.2%) (Table 3). This suggests that the significantly higher feed intake recorded for T3 might have resulted in higher intake of nutrients which might have translated into the slightly better performance. This result is similar to the findings of Gous *et al.* (1987) who reported that energy concentration had no effect on egg production other than via its effect on feed intake.

Table (3): Weekly egg production (%) of the experimental birds.

Age (weeks)	T1 (2,800)	T2 (2,500)	T3 (2,300)
129	75.6	74.4	71.7
130	81.7	83.3	74.4
131	80.5	76.1	76.7
132	81.7	82.2	77.8
133	81.1	78.3	81.7
134	82.8	70.5	82.8
135	78.3	73.9	83.9
136	78.3	77.8	81.1
137	76.7	71.1	79.5
138	77.2	76.1	78.9
139	68.2	74.5	84.4
Mean	**78.4**	**76.2**	**79.4**

Egg weight was similar between the treatments. The mean values of 60.7, 60.3 and 60.3 g for T1, T2 and T3 respectively did not differ significantly (Table 4). This result is similar to the report of Summers and Leeson (2005), Sell *et al.,* (1987) and Keshavarz and Nakajima (1995). It however contradicts the report of Colvara *et. al.* (2002) and Harms *et al.* (2000) who reported that egg weight is affected by dietary energy concentration.

Feed conversion ratio was also similar amongst the treatments (Table 4). This result is similar to the findings of some authors who reported that dietary energy level does not influence feed conversion ratio (Keshavarz, 1998; Grobas *et al.,* 1999a; Costal *et al.* 2004); but contradicts the findings of others (Grobas *et al*., 1999; Wu *et al*., 2005, 2007; Volknen *et al*., 2008).

From the table (4) the Cost of feed decreased with decreasing levels of dietary energy. This was mainly due to the fact that maize was the major energy yielding nutrient in the diets, and its proportion decreased with decreasing ME levels of the diets. Thus, cost of feed decreased by 17.1% as the dietary ME level was reduced from 2,800 (₦121.6/kg) to 2,300 kcal/kg (₦100.8/kg). Thus, the higher cost of feed for T1 was offset by the higher feed intake recorded for the other treatments. However, despite this, cost of feed (₦/egg) was lower for T3 (18.1) compared to the other treatments (19.5 and 20.1 for T1 and T2 respectively). Even though the differences were not significant, this suggests better economic return with the lowest energy density diet (T3).

Table (4): Feed conversion ratio and cost of feed of laying hens fed diets containing varying energy levels between the 129th and 139th weeks of age.

	Treatments (ME (kcal/kg) levels		
	T1 (2,800)	T2 (2,500)	T3 (2,300
Feed conversion ratio	2.01	2.16	2.34
Cost of feed (₦/kg)	121.6	109.0	100.8
Cost of feed consumed (₦/b/d)	14.4	14.0	13.7
Cost of feed (₦/egg)	19.5	20.1	18.1

CONCLUSION

An experiment was conducted to determine the effect of feeding diets containing 2,800 (T1), 2,500 (T2) and 2,300 (T3) kcal/kg of ME to laying hens between the 129th and the 139th weeks of age. Results showed that feed intake significantly increased (P<0.05) from 118.8g/b/d for T1 to 128.1 and 135.5 g/b/day for T2 and T3, respectively. However, egg production did not vary significantly between the treatments, though a slightly higher value was recorded for T3 (79.3%) compared to T1 (78.4%) and T2 (76.2%). Egg weight and FCR did not also differ significantly between the treatments. Cost of feed (₦/kg) reduced by 17.1% from T1 to T3. However, cost of feed consumed (₦/b/d) reduced by only 4.9% from T1 to T3. Consequently, cost of feed / egg was lower for T3 (₦18.1) compared to T1 (₦19.5) and T2 (₦20.1), though the differences were not significant (P>0.05).

These results tend to point to better economic benefit with the lowest energy density diet.

RECOMMENDATIONS

It is recommended that future studies should involve digestibility trials to ascertain levels of nutrients intake and utilization. This will provide an opportunity for better appraisal of how different dietary energy concentrations influence feed utilization.

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