SEMEN TRAITS OF NOILER COCKS FED DIFFERENT DIETARY PROTEIN AND ENERGY LEVELS

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ABSTRACT

In a study to assess the influence of dietary protein and energy levels on semen traits of noiler cocks, 18 cocks were randomly selected across the treatment groups comprising of 3 dietary protein (17%, 19% 21%) and 2 energy (2800kcal/kg ME, 3000kcal/kg ME) levels at 32 weeks of age (32 WOA) and 40 weeks of age (40 WOA). Body weights of the cocks were recorded at each period of collection and semen samples were collected by the double handed massage method and evaluated for appearance, volume, motility, sperm concentration and morphology using standard laboratory procedures. Data collected were analysed in a 3 x 2 factorial design in a completely randomized model. Results obtained revealed that at 32 weeks of age, neither dietary protein nor energy levels had significant ($p>0.05$) effects on body weight, semen volume, morphology and abnormality. However, motility was significantly ($p<0.05$) influenced by dietary protein level. At 40 weeks of age, body weight, semen volume, head-to-head and tail abnormalities were not affected ($p>0.05$) by dietary protein levels. Sperm concentration (at both 32 and 40 WOA) and morphology (40 WOA) improved ($p<0.05$) at 3000 kcal/kg metabolizable energy. It is concluded that dietary crude protein as low as 17% and energy levels between 2800 and 3000 kcal/kg ME can provide adequate nutrients to support semen production in noiler cocks up to 40 weeks of age.

Keywords: Noiler cock, Dietary protein, Energy, Semen traits

Introduction

Increase in human population has placed a great demand on increase of poultry products. Provision of adequate nutrients is essential for all classes of poultry as these nutrients are needed to meet the maintenance, growth and productive requirements. However, cost of production of poultry has increased due to increasing cost and non - availability of feed ingredients. The major concern in feed formulation for poultry diet is the cost of protein and energy feedstuffs. The Noiler strain is a dual-purpose breed of chicken developed in Nigeria by Amo Farm Sieberer Hatchery. The strain has been reported to be suitable for rural communities and smallholder farmers and can address the challenges of animal food insecurity. The Noiler chickens have been reported to have a rapid growth rate like broilers and more resistant to diseases like the indigenous breeds of chickens. The role of the cock in poultry reproduction is important as it is responsible for the production of fertile eggs (Lagares *et al*., 2017, Wu *et al*., 2017). The characteristics of semen are evaluated to assess and predict male fertility (Sun *et al*., 2019). Semen production and fertility can be influenced by plane of nutrition and it has been reported that decrease in semen characteristics such as testicular weight, semen volume, sperm concentration and motility can occur in cocks older than 45 weeks of age (Lagares *et al*., 2017).

The relationship between nutrition and **reproductive performance** in farm animals is well known. Hudson (2022) **reported that nutrition of male broiler breeders has evolved over recent decades. The female CP requirement in the production phase is generally higher than that of the male due to the higher requirement for egg production compared to spermatogenesis.** Research has shown that deficiencies of various trace minerals, inadequate vitamin intakes, energy-protein imbalances and excessive protein intakes contribute to infertility and poor **reproductive performance** of animals including chickens. For developing nations of the world to bridge the usual shortfalls in animal protein production and consumption among their human populations, adequate feed resources must be developed to meet the nutritional needs of its livestock. (Kalyan et al., 2017). Nutritional factors can modulate the detrimental impact of aging on the reproductive organs, semen traits, and fertility of poultry males. Therefore, this study assessed the effects of dietary protein and energy levels on semen traits of Noiler cocks.

MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm of the University of Ilorin, Ilorin, Kwara State. A total of 180 noiler cocks from an existing baseline population were randomly allocated to six dietary treatments consisting of 2 energy levels and 3 protein levels (Table 1). Each treatment group was replicated thrice and constituted of eighteen pens of ten noiler birds each. The treatment groups are as follows:

A: Birds fed with diet with 21% protein and energy level of 3000kcal/kg. B: Birds fed diet with 19% of protein and 3000kcal/kg energy level. C: Birds fed diet with 17% of protein and 3000kcal/kg energy level. D: Bird fed

diet with 21% protein and 2800kcal/kg energy level. E: Birds fed diet with 19% protein and 2800kcal/kg energy level. F: Birds fed diet with 17% protein and 2800kcal/kg energy level.

The birds were raised under similar environmental, managerial and veterinarian conditions in a closed house; artificial lighting and drinking water were provided throughout the experimental period.

Table 1: Composition of experimental diets (Growers mash)

	3000 ME/ 19% CP	2800 ME/ 19% CP	3000 ME/ 17% CP	2800 ME/ 17% CP	3000 ME/ 21% CP	2800 ME/ 21% CP
Maize	62	64	58.5	58	60	51
Soybean	10	6	15	15	7	10
GNC	13	12	-	-	17.5	16
Wheat offal	9	10	18.5	21	5.5	16
Fishmeal	2	4	2	2	5	3
Palm oil	1	-	-	-	1	-
Bone meal	1	2	2	2	2	2
Oyster shell	1	1	1	1	1	1
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Energy	3030.92	2805	3009	2800	3046	2828
Protein	18.97	19.14	16.66	17	21.03	21.03

Semen Collection

Semen collection was performed at thirty-two (32) and forty (40) weeks of age of the noiler cocks. A cock was selected from each replicate and semen was collected into a hand-warmed collection tube by skilled personnel, following the manual massage method described by Barrows and Quinn (1937) and Mocé and Graham (2008). Semen volume was measured with the use of a graduated collection tube. Semen appearance was assessed subjectively using scoring scale modified from Zemjanis (1970): 3 for milky, 2 for creamy, 1 for light cream, and 0 for bloodshot.

Semen Quality Determination

The air-dried slides after staining were examined under a light microscope (Olympus Corp., Tokyo, Japan) at 400× magnification. For evaluation of sperm motility, 2 µL of semen diluted with 50 µL of normal saline (Tiangen Biotech Corp., Beijing, China) was placed on a preheated slide and cover slipped. Sperm motility was estimated by video-microscopy at 400× magnification (Tabatabaei et al., 2009). Sperm deformity (% using 500 spermatozoa) was determined using the *in vivo* crystal violet staining method (Santiago-Moreno et al., 2009). After staining, air-dried slides were examined at 400×magnification to identify those displaying morphological abnormalities (including abnormalities in the head, connecting piece, tail, and end piece).

Statistical analysis

All data were analyzed as completely randomized design (CRD) in a 3 x 2 factorial model, as outlined by Daniel (1995). Value of $p < 0.05$ was considered statistically significant and means were separated by Duncan multiples Range test.

RESULTS AND DISCUSSION

Effects of dietary protein and energy levels on semen traits of noiler cocks aged 32 weeks are shown in Table 2. Neither dietary protein nor energy levels had significant ($p>0.05$) effects on body weight, semen volume, morphology and abnormality. However, motility was significantly ($p<0.05$) influenced by dietary protein level with least motility (40.00%) recorded for cocks fed 19% protein. Sperm concentration was higher ($p<0.05$) in semen of cocks fed 3000kcal/kg. Motility and sperm concentration were improved ($p<0.05$) at the 3000 kcal/kg over 2800 kcal/kg metabolizable energy at 17 and 19% levels of protein but were similar ($p>0.05$) for both energy levels at 21% protein. Effects of dietary protein and energy levels on semen characteristics of 40 weeks old noiler cocks are shown in Table 3. Body weight, semen volume, head-to-head and tail abnormalities were not affected ($p>0.05$) by dietary protein levels.

Table 2: Effects of dietary protein and energy levels on semen traits of Noiler cocks at 32 weeks of age

Parameters	Body weight (g)	Volume (ml)	Motility (%)	Concentration (cells/ml)	Morphology (%)	Head-to- head (%)	Tail defect (%)
Protein (%)							
17	3183.3	0.058	61.67[b]	88.33	63.33	1.50	1.83
19	2983.3	0.065	40.00[c]	68.33	61.67	1.83	2.17
21	3116.7	0.065	75.00[a]	78.33	76.67	1.33	1.00
SEM	270.80	0.02	22.72	28.33	14.06	0.62	0.97
P value	0.4026	0.537	0.015	0.587	0.126	0.381	0.093
Energy (kcal/kg)							
2800	3133.3	0.05	47.78	61.11[b]	58.89	1.67	2.00
3000	3055.6	0.06	70.00	88.89[a]	74.44	1.44	1.33
SEM	253.15	0.02	22.70	28.30	14.00	0.6	0.97
P value	0.531	0.363	0.097	0.055	0.062	0.460	0.150
P*E	NS	NS	*	*	*	NS	*

[abc:] means along the same column with different superscripts are significantly ($p<0.05$) different

Table 3: Effects of dietary protein and energy levels on semen traits of noiler cocks at 40 weeks of age.

Parameters	Body weight(g)	Volume (ml)	Motility (%)	Concentration (%)	Morphology (%)	Head-to-head (%)	Tail defect (%)
Protein (%)							
17	3183.3	0.06	61.67[b]	81.67[a]	63.33[b]	1.50	1.83
19	2983.3	0.06	40.00[c]	65.00[b]	61.66[b]	1.83	2.17
21	3116.6	0.05	75.00[a]	68.33[ab]	73.67[a]	1.33	1.00
SEM	253.15	0.02	6.67	78.90	14.07	0.55	0.67
P value	0.6828	0.6049	0.0078	0.2202	0.0483	0.1573	0.1906
Energy (kcal/kg)							
2800	3133.3	0.05	50.00	53.89[b]	58.88[c]	1.67	2.00
3000	3055.6	0.06	70.00	83.11[a]	73.33[a]	6.22	1.33
SEM	253.00	0.01	24.74	80.94	12.47	0.38	0.97
P value	0.6828	0.6047	0.0977	0.0220	0.0483	0.1511	0.0936
P*E	NS	NS	*	*	*	NS	NS

[abc:] means along the same column with different superscripts are significantly ($p<0.05$) different

Highest motility (75.0%) and morphology (73.67%) were recorded in semen from cocks fed 21% protein, while lowest values were obtained in semen from cocks fed 19% protein. Sperm concentration declined ($p<0.05$) at protein levels above 17%. Dietary energy levels had no significant ($p>0.05$) effect on body weight, semen volume, motility, head-to-head and tail defect. Sperm concentration and morphology improved ($p<0.05$) at 3000 kcal/kg metabolizable energy.

Zhang *et al*. (1999) had reported that dietary crude protein had no effect on semen volume and if any, it was due to change in body weight of broiler breeders. From this experiment and literature, it seems that Noiler males can be provided a dietary CP of 17% without any adverse effect on semen parameters. Murugesan *et al*. (2016) reported no significant effect of low crude protein level on semen parameters and fertility. Results obtained in this study is similar to the reports of Xue *et al*. (2022), who observed non-significant effects of energy level on semen volume, viability in yellow-feathered breeder cocks, however motility was improved with medium energy diet.

CONCLUSION

Based on the results of this experiment it may be concluded that dietary crude protein as low as 17% does not affect body weight and semen parameters of Noiler chicken. Also the levels of protein and energy used in this study were sufficient to provide the cocks with adequate nutrients up to 40 weeks of age.

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