

Original Research Article

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Blood Biochemical Profile of Swarnadhara Grower Parents as Influenced by Different Levels of Energy and Protein in the Diet

N. Suma^{1*}, B. S. Venkatarami Reddy¹, S. Naveen Kumar², K. P. Chethan³,
G.U. Manju³ and J. Adarsh¹

¹Department of Animal Nutrition, Veterinary College, KVAFSU, Bengaluru 560 024, India

²Department of Animal Genetics and Breeding, Veterinary College, KVAFSU,
Bengaluru 560 024, India

³Department of Animal Nutrition, Veterinary College, KVAFSU, Hassan, India

**Corresponding author*

ABSTRACT

A feeding trial was conducted in female parent stock of Swarnadhara for 8 weeks during grower stage. Test diets were formulated at variable levels of energy (2500 / 2400 kcal ME / kg) and protein (16 / 15 % CP) to form 4 treatments (High Energy/High Protein-T₁; High Energy/Low Protein T₂; Low Energy/High Protein-T₃ and Low Energy/Low Protein-T₄). 384 grower birds (13 – 20 weeks age) were divided into 32 replicates of 12 birds each to offer four diets randomly to 8 replicate groups under deep litter system. A linear increase in calcium concentration over all from beginning to the end of the experiment in all the dietary groups was observed. But, the pooled mean serum calcium ($P \geq 0.05$) values were 14.8, 14.6, 14.7 and 14.8 mg/dl in groups T₁, T₂, T₃ and T₄, respectively. However, the pooled mean plasma inorganic phosphorus values ranged non-significantly ($P \geq 0.05$) from 5.9 (T₂) to 6.3 mg/dl (T₃). The varied results indicate a gradual increase in concentration of both the minerals as age advanced. Chosen energy as well as protein levels of Swarnadhara birds during grower stage have showed no adverse effect with respect to blood mineral profile.

Keywords

Blood mineral profile, Deep litter system, Energy, Grower stage, Protein Swarnadhara

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Introduction

Poultry and poultry products owe for the better protein to human beings economically at lower price. Global meat production has been increased from 125 million MT in 2018 to 128.4 million MT in 2019 showing just 3

% growth. However, global egg production of about 80.1 million MT in 2017 witnessed an increase of nearly 25% from last 10 years. Whereas, India stands 3rd in both poultry meat and egg production after China and USA with production of about 4.85 million MT of meat and 88.14 billion eggs and making proud as

one among the world's largest producers (Poultry Trends, 2019).

Though the modern intensive poultry production has achieved dramatic gains in the efficient and economical production of high quality and safe chicken meat, eggs and poultry by-products, about 90 per cent of families engaged in backyard poultry keep an average of 10 to 15 adult low producing desi fowls maintained by women.

Vast majority of people in rural areas in general and harsh environments in particular have a strong liking for colored birds since they escape from the predators being camouflaged by their color (Krishna Rao, 2002; Veeranna, 2019).

Scavenging / free range / semi intensive poultry production is having many constraints which need proper appraisal for the success are lack of improved germplasm suitable for rural conditions, supplementation of small quantity of balanced feed to the birds besides natural resources as well as lack of technical know-how (Johri and Shrivastava 2005; Singh, 2005). In this direction, Swarnadhara, is one among such strains to fulfill economically weaker people desire for better production traits.

Nutrient requirements for Swarnadhara birds may differ from that of extensively documented Leghorn type breeds despite their high survivability under scavenging conditions. Hence, breeder stock should be provided with balanced ration to exploit its genetic potential as well as to multiply a large number suitable for rural conditions.

In this direction, a concise study to know the effect of varied levels of energy as well as protein in ration of Swarnadhara grower parents on blood parameters was planned.

Materials and Methods

Parent stock of Swarnadhara strain; akin to country fowl which was developed for rural scavenging conditions were selected for study in grower stage.

Experimental diets

Grower mash diets of T₁ to T₄ were formulated using yellow maize, deoiled rice bran, soybean meal, sunflower extractions, salt, mineral mixture and additives to interrelate two levels of energy with two levels of protein. Diet description of the experiment is given in Table 1.

The dietary details regarding ingredient composition is being given in Table 2 and all the diets formulated were subjected for analysis according to standard procedures (AOAC, 2005). Whereas, the calculated nutrient profile of the different diets is detailed in Table 3.

Experimental birds' randomization

A total number of 384 Swarnadhara female parent stock of about 9 weeks age were selected. And were stabilized for 21 days being fed with a restricted conventional practical grower mash diet. At the birds age of 12 weeks, all were divided into 32 groups of 12 birds each and each of the previously mentioned 4 diets was offered randomly to 8 groups to make replicates per treatment. Experiment was carried out by a completely randomized design.

All the birds were housed under deep litter system provided with paddy husk as the litter material. From 13 to 20 weeks of experimental period, feed restriction programme was followed to maintain the ideal body weight of the breeder flock. All the pens were provided with a tubular type of

feeder and a continuous channel type of waterer on both sides of the house for clean and fresh water. By and large care was taken to distribute replications uniformly in all treatments.

Experimental care during trial

Beak trimming (upper 1/3rd) was done using electrical debeaker to prevent cannibalism for all the experimental birds at the age of 10th week and during 11th week, they were dewormed using levamisole (@ 13 mg/kg BW) through feed. Subsequently, all the birds were vaccinated against New Castle Disease using live vaccine through subcutaneous route during 12th week. That apart, all the birds were maintained under uniform standard managerial conditions including lighting programme, preventive or therapeutic disease control schedule, feeding frequency, watering methods and other routine bio-security aspects. This experiment lasted for 56 days which was conveniently divided into four 14-day interval periods for sorting arrived data.

Blood biochemical profile

Two birds were randomly selected from each replication at the start of the experiment (i.e., 12th week of birds' age) and 2 ml of blood was collected from its wing vein. 1 ml of blood collected from each bird was transferred into a clean, sterilized and labeled test tube containing EDTA for plasma separation and other 1 ml of the blood collected was transferred into a clean, sterilized and labeled test tube for serum separation. The contents of EDTA containing test tubes were centrifuged and the supernatant plasma was collected in a vial which was clean, sterilized and labeled. The other test tube without EDTA was held in a slanting position for serum separation as per the standard procedures (Calneck *et al.*, 1992) and the clear non-haemolysed serum was then

transferred into a vial which was clean, sterilized and labeled. Later, separated serum and plasma samples were stored at -20^oC for further estimation of calcium and inorganic phosphorus, respectively. Further, the same birds were bled to collect the blood and separated plasma as well as serum at subsequent 28-day intervals.

The inorganic phosphorus and calcium contents of plasma and serum samples, respectively, were analyzed using auto-analyzer (BT-224 photometer) as described by commercial supplier (M/s. Span Diagnostics).

Statistical analysis

The data pertaining to blood mineral profile obtained during the grower experimental trial were analyzed in completely randomized design according to the procedures described by Snedecor and Cochran (1989).

Results and Discussion

Experimental diets composition

The proximate composition including that of calcium and phosphorus of experimental grower diets compounded on different occasions of the 56-day experimental period analyzed is given in Table 4.

The dry matter (DM) content estimated for experimental diets ranged from 90.54 (T₄) to 91.23 (T₁) per cent while that of analyzed crude protein (CP) content was 16.42, 15.02, 15.96 and 15.23 per cent, respectively in T₁, T₂, T₃ and T₄ diets in that order. The ether extract (EE), crude fiber (CF), total ash (TA) and nitrogen free extractives (NFE) of experimental diets were ranging from 1.98 (T₄) to 2.33 (T₂); 10.12 (T₁) to 12.11 (T₄); 8.32 (T₃) to 9.41 (T₄) and 61.27 (T₄) to 62.97 (T₂) per cent, respectively.

The mineral composition analyzed for calcium and phosphorus of the test diets were ranged from 1.26 (T₂) to 1.31 (T₁) and 1.14 (T₁) to 1.21 (T₂), respectively. Whereas, the calculated metabolizable energy (ME) values were found to be 2534 (T₁), 2524 (T₂), 2448 (T₃) and 2441 (T₄) kcal/kg.

All the laboratory analyzed values were fairly in close agreement with the calculated values, based on which the formulation of diets was indeed attempted. Noticed an incremental level of crude fiber in low density diets compared to their counterparts was obviously due to gradual increase in deoiled rice bran as well as sunflower extractions on one hand and gradual decrease in maize as well as soybean meal on the other hand. Contrarily, the estimated calcium as well as the total phosphorus content of all the diets was slightly higher than the calculated ones.

The protein levels chosen in the T₂ and T₄ test diets of the present study were close to the value as recommended by [9]. However, the other two diets i.e., T₁ and T₃ were selected with slightly higher protein values to see the counter effect, if any. Contrarily, the metabolizable energy levels were much lower than the values recommended by Reddy and Rajendiran (2002).

Blood mineral profile

The blood mineral profile viz. serum calcium and plasma inorganic phosphorus contents of birds under different treatments at every 28-day interval for three consecutive times as well as pooled mean values of 56-day experimental period are presented in Table 5 and Table 6, respectively.

The mentioned blood mineral profiles under different treatments were found to be statistically ($P \geq 0.05$) similar throughout the experiment.

The non-significant ($P \geq 0.05$) mean values of serum calcium at beginning (1st day), 28th day and 56th days of the trial ranged respectively, from 14.1 (T₂) to 14.3 (T₄); from 14.7 (T₂) to 15.0 (T₄) and from 15.0 (T₂) to 15.5 (T₁) mg/dl. Lower serum calcium values were recorded in high energy low protein group (T₂) throughout the experiment while the low energy low protein group (T₄) revealed higher values on initial stages but however, on 56th day the highest value was seen in high energy high protein fed group (T₁). Overall, there was a linear increase in calcium concentration over all from beginning to the end of the experiment in all the dietary groups. The pooled mean ($P \geq 0.05$) values were 14.8, 14.6, 14.7 and 14.8 mg/dl in groups T₁, T₂, T₃ and T₄, respectively.

Table.1 Description of dietary levels of energy and protein for different experimental diets

Treatment		Metabolizable Energy (kcal/kg)	Crude Protein (%)
No.	Description		
T ₁	High Energy High Protein	2500	16
T ₂	High Energy Low Protein	2500	15
T ₃	Low Energy High Protein	2400	16
T ₄	Low Energy Low Protein	2400	15

Table.2 Composition of different ingredients of experimental diets compounded during feeding trial

Ingredient, kg	T ₁	T ₂	T ₃	T ₄
Maize	444	440	374	373
De-oiled rice bran	270	305	330	350
Soybean meal	60	28	25	0
Sunflower extractions	188	189	233	239
Salt	3	3	3	3
Mineral mixture ¹	35	35	35	35
Total	1000	1000	1000	1000
Additives, g/ton				
AB₂D₃K ²	150	150	150	150
B complex ³	200	200	200	200
DL-Methionine ⁴	500	500	500	500
Coxistat ⁵	750	750	750	750
Albac ⁶	300	300	300	300

¹ Mineral mixture contained: Moisture – 3 %, Ca – 32 %, P – 9 %, Mn – 0.27 %, Zn – 0.26 %, I – 0.01 %, Cu – 0.01 %, Fe – 0.10%, FI – 0.03% (Max).

² Each gram contained: Vitamin A - 82,500 IU, Vitamin B₂- 50 mg, Vitamin D₃- 12,000 IU, Vitamin K - 10 mg, Organic Nutritive Carrier – Q.S.

³ Each gram contained: Vitamin B₁ - 4 mg, Vitamin B₆- 8 mg, Vitamin B₁₂- 40 µg, Vitamin E - 40 mg, Calcium-d-pantothenate - 40 mg, Niacin - 60 mg, Organic Nutritive Carrier – Q.S.

⁴ Each gram contained: DL-Methionine - 980 mg.

⁵ Anticoccidial contained Maduramycin Ammonium – 1%

⁶ Antibiotic growth promoter contained Zinc Bacitracin - 15%

Table.3 Nutrient profile of experimental diets compounded during feeding trial

Nutrient	T₁	T₂	T₃	T₄
ME kcal/kg	2534	2524	2448	2441
CP %	16.22	15.36	16.27	15.65
EE%	2.08	2.08	1.92	1.92
LA %	1.14	1.12	1.02	1.01
CF %	9.71	9.98	11.22	11.46
Ca %	1.20	1.19	1.20	1.19
TP %	1.06	1.09	1.14	1.16
Pav %	0.45	0.44	0.44	0.44
Na %	0.16	0.16	0.16	0.16
Cl %	0.24	0.24	0.24	0.16
K %	0.76	0.74	0.78	0.76
Mg mg	0.40	0.41	0.45	0.47
S %	0.17	0.16	0.17	0.17
Fe ppm	246	247	228	229
I ppm	3.50	3.50	3.50	3.50
Cu ppm	7.07	6.48	6.29	5.81
Mn ppm	102	101	101	101
Zn ppm	105	105	105	105
Se ppm	0.02	0.02	0.01	0.01
Met %	0.33	0.32	0.34	0.33
Met + Cyst%	0.55	0.53	0.56	0.55
Lys %	0.62	0.56	0.60	0.56
Arg %	1.06	1.00	1.08	1.04
Ratios				
C/P	156	164	150	156
Ca/Pav	2.70	2.70	2.71	2.71
Arg/Lys	1.71	1.78	1.81	1.88

Table.4 Chemical composition of analysed experimental diets compounded during grower phase of the experiment

Treatment		Proximate Composition (%) ¹						Minerals (%)		ME ² (kcal /kg)
No.	Description	Dry matter	Crude Protein	Ether Extract	Crude Fiber	Total Ash	NFE	Ca	P	
T ₁	High Energy High Protein	91.23	16.42	2.28	10.12	8.84	62.34	1.31	1.14	2534
T ₂	High Energy Low Protein	91.14	15.02	2.33	10.56	9.12	62.97	1.26	1.21	2524
T ₃	Low Energy High Protein	90.79	15.96	2.01	10.87	8.32	62.84	1.27	1.15	2448
T ₄	Low Energy Low Protein	90.54	15.23	1.98	12.11	9.41	61.27	1.30	1.19	2441

¹ Average values of samples on 4 occasions.

² Calculated value

Table.5 Serum calcium profile of experimental birds fed different diets during different time intervals of grower trial

Treatment		Serum Ca (mg/dl) ^{NS}							
No.	Description	1 st Day		28 th Day		56 th Day		Mean	
T ₁	High Energy High Protein	14.2	± 0.25	14.8	± 0.45	15.5	± 0.19	14.8	± 0.18
T ₂	High Energy Low Protein	14.1	± 0.39	14.7	± 0.33	15.0	± 0.48	14.6	± 0.23
T ₃	Low Energy High Protein	14.3	± 0.33	14.7	± 0.46	15.2	± 0.45	14.7	± 0.26
T ₄	Low Energy Low Protein	14.3	± 0.37	15.0	± 0.41	15.2	± 0.38	14.8	± 0.21
CD		-		-		-		-	
F-value		0.09		0.14		0.32		0.24	

^{NS} Non-significant

Table.6 Plasma inorganic phosphorous profile of experimental birds fed different diets during different time intervals of grower trial

Treatment		Plasma inorganic P (mg/dl) ^{NS}							
No.	Description	1 st Day		28 th Day		56 th Day		Mean	
T ₁	High Energy High Protein	5.8	± 0.12	5.9	± 0.22	6.7	± 0.27	6.1	± 0.15
T ₂	High Energy Low Protein	5.6	± 0.25	6.0	± 0.19	6.1	± 0.31	5.9	± 0.17
T ₃	Low Energy High Protein	5.7	± 0.18	6.0	± 0.21	7.0	± 0.32	6.3	± 0.13
T ₄	Low Energy Low Protein	5.9	± 0.09	6.1	± 0.19	6.0	± 0.45	6.0	± 0.16
CD		-		-		-		-	
F-value		0.52		0.15		1.87		1.04	

With regard to the plasma inorganic phosphorus levels, the values varied non-significantly ($P \geq 0.05$) from as low as 5.6 (T₂) to as high as 5.9 (T₄) mg/dl on 1st day; from 5.9 (T₁) to 6.1 (T₄) mg/dl on 28th day and from 6.0 (T₄) to 7.0 (T₃) mg/dl on 56th day. Quite similar to calcium, highest values were recorded again in low energy low protein fed group (T₄) during initial stages of the experiment and also found gradual increase in concentration over a time period. The pooled mean values ranged non-significantly ($P \geq 0.05$) from 5.9 (T₂) to 6.3 mg/dl (T₃).

Similar results were observed in an experiment supplemented with turmeric powder and ginger powder in broiler ration with no difference ($P > 0.05$) among serum calcium and phosphorus levels and concluded that supplementation is good (Sahoo *et al.*, 2018). Likewise, one more study conducted to evaluate the effects of dietary supplementation with calcium varying in particle size and different calcium sources on blood calcium concentration with comparing vitamin D₃ supplementation in laying hens

showed no significant influence on blood calcium concentration, however, there was a linear tendency to increase (Park *et al.*, 2017).

A study in Chabro chicken on macro mineral content in blood was found within normal physiological range fed with different levels of azolla (Mishra *et al.*, 2016). Likewise, Swarnadhara birds fed with reducing dietary crude protein levels supplemented with limiting amino acids in both chick as well as layer stage showed statistically similar ($P \geq 0.05$) serum calcium and inorganic phosphorus values (Beena *et al.*, 2017; Beena, 2017). Since no published normal physiological values for the said minerals with respect to Swarnadhara strain at grower stage, analysed values were quite acceptable without any adverse effects and hence were considered to be present in the normal range.

In conclusion, selected levels of both energy as well as protein in this experiment have showed no deleterious effect on bird's health with respect to the blood biochemical profile.

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