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Effect of Varying Levels of Dietary Energy on Proximate Composition in Breast Meat of Native Chicken

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ABSTRACT: Native chickens are reared under intensive system to meet out the demand for their meat and eggs. The optimum requirement of nutrients for profitable intensive farming besides gratify the perceived qualities and unique characteristics of native chicken. The present study was performed to study the effect of dietary levels of energy on breast meat proximate composition of Aseel native chicken under intensive system of management. Five experimental diets were formulated having energy levels of (ME) i.e., 2600, 2700, 2800, 2900 and 3000 kcal/kg with an iso-nitrogenous crude protein (CP) of 21 %. A total of 400-day old Aseel chicken chicks were randomly divided into five groups of eight replicates (four male and four female), each of 10 chicks. At the end of 15 weeks of the experiment, breast muscle samples were harvested for proximate analysis and data were subjected to statistical analysis. The increased energy level in T_5 group (3000 ME kcal/kg) had significantly reduced crude protein per cent in breast meat of female group (22.57 %). Whereas, different energy diets had no significant effect on protein per cent in breast meat of male and overall native chickens. The energy levels of the diet had significant effect on crude fat per cent in breast meat of male, female and overall Aseel chicken. The reduction in energy level increased fat per cent in breast meat of Aseel chicken. The maximum fat (1.41 %) was recorded in T_2 (2600 ME kcal/kg) group of breast meat of female Aseel chicken. Diets with varying dietary energy levels had significant effect on ash content in breast meat of male, female and overall Aseel chicken. The reduced fat per cent (1.01%) and increased ash content (1.71%) in breast meat was observed in T_4 (2900 ME kcal/kg) male group, increased fat (1.41%) and ash content (1.51%) in breast meat was observed in T_2 (2600 ME kcal/kg) group of female Aseel chicken. In overall Aseel chicken T_4 group (2900 ME kcal/kg) recorded lowest fat per cent (0.96 %) and higher ash content (1.46 %) in breast meat. These results revealed that, an appropriate energy level may be chosen while formulating diet for male and female Aseel chicken to enhance the quality and value of breast meat.

Key words: Aseel native chicken, breast meat composition, energy density

INTRODUCTION

Native chicken farming is one of the most promising growing sectors transformed from a traditional backyard rearing to intensive farming. In India native chickens contributed about 11.50 % of the total egg production in the year 2019 (BAHS, 2019). The consumption of native chicken meat is rising due to its nutritive value, desirable taste and flavour. The value and quality of poultry meat is estimated by analysing the major proximate compositions such as proteins, fats, carbohydrates, minerals and fatty acid levels (Pearson and Gillet, 1996).

Native chicken meat is preferred for less fat and higher ash content with unique flavour and aroma. The important factors such as breed, age, sex, type of rearing and level of nutrients had been revealed to affect composition and value of poultry meat (Boskovic *et al*., 2010). Selection of nutrient levels for chickens has a significant impact on poultry meat quality and safety. The supply of adequate nutrients in native

chicken diets from day old up to marketing age exerts a substantial impact on proximate composition of meat.

In recent years, native chickens are being reared under intensive system in order to meet out the demand for their meat and eggs. Consumers are ready to pay premium price for meat and eggs of native chickens due to their perceived qualities (Haunshi and Rajkumar, 2020). Efforts are being carried out to enhance the productivity of the birds without compromising the unique breed characteristics of native chickens.

The accumulation fat occurs in birds after attaining maximum growth rate, which is followed by a reduction in growth rate and protein deposition, whereas fat deposition increased. The excess supply and available nutrients are utilized for lipogenesis and fat accretion. Improvements in weight gain, feed efficiency, immune response and fat deposition require upright diet formulation and optimum nutrient levels. An appropriate energy level is most important factor to reduce feed cost per unit of weight gain (NRC, 1994). Non-availability of specific feed and higher feed cost are the major constraints faced by the farmers rearing native chickens intensively (Balamurugan *et al*., 2019). With these facts, the present study was formulated to determine the effect of different dietary energy levels on nutrient composition of breast meat of Aseel native chicken.

MATERIALS AND METHODS

A. Experimental birds

A total of 400 sexed day old Aseel native chicken chicks were used to evaluate the effect of different levels of energy in an isonitrogenous diet on meat proximate composition of Aseel chickens. The birds were randomly divided into five treatments and eight replicates (four male and four female groups) of 10 chicks each. Birds were reared for 15 weeks under deep litter system of management following standard management protocol. Feed and fresh water was provided *Ad libitum* throughout the experiment period. This study was carried out at Department of Animal Nutrition, Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, India.

B. Experimental diets

Five experimental diets were formulated having five levels of energy (ME) i.e., 2600, 2700, 2800, 2900 and 3000 kcal/kg with an iso-nitrogenous crude protein (CP) level of 21 % (Table 1). The control group (T_1) fed with 2800 kcal ME /kg and 21 % of CP, the lower two ME levels of 2600 and 2700 kcal/kg diets were fed with T_2 and T_3 respectively. The higher two ME levels of 2900 and 3000 kcal/kg diets were fed with T_4 and T_5 group, respectively.

Table 1: Ingredient and nutrient composition of experimental diet (per cent).

Ingredients	Kcal / Kg of ME in an isonitrogenous diet (21 % CP)				
	T_1 (2800)	T_2 (2600)	T_3 (2700)	T_4 (2900)	T_5 (3000)
Maize	56.40	42.05	49.26	59.67	57.39
Deoiled rice bran	5.59	24.37	14.88	0.00	0.00
Soybean meal	34.27	30.00	32.18	35.73	36.18
Vegetable oil	0.00	0.00	0.00	0.79	2.67
Dicalcium phosphate	1.84	1.74	1.79	1.87	1.87
Calcite	1.16	1.11	1.13	1.17	1.17
Lysine	0.00	0.02	0.00	0.00	0.00
Methionine	0.12	0.12	0.12	0.12	0.12
Salt	0.38	0.36	0.39	0.41	0.36
Premix#	0.24	0.24	0.24	0.24	0.24
Total	100.00	100.00	100.00	100.00	100.00
Nutrient composition					
Dry matter	89.05	90.09	89.96	90.20	89.95
Crude protein	21.09	21.06	21.10	20.98	20.89
Crude fibre	4.25	5.84	4.39	3.31	3.32
Ether extract	3.54	2.97	3.07	4.98	6.89
Total ash	6.70	7.14	6.89	5.96	6.70
Calcium	0.99	1.06	1.03	1.09	1.05
Total Phosphorus	0.78	0.80	0.80	0.78	0.72
Lysine*	0.96	0.95	0.95	0.97	0.98
Methionine*	0.40	0.39	0.40	0.40	0.40

#Composition per kg of diet: Vitamin A - 8,250 IU, Vitamin B_2 - 5 mg, Vitamin D_3 - 1200 IU and Vitamin K -1 mg. Thiamine – 0.80 mg, Pyridoxine – 1.6 mg, Cyanocobalamin – 8.0 µg, Vitamin E – 8.0 mg, Niacin - 12 mg, Calcium-d-pantothenate - 8 mg, Folic acid – 0.8 mg. Coccidiostat - Salinomycin 12%., Manganese – 5.4 mg, Zinc – 5.2 mg, Iron – 2 mg, Iodine – 0.2 mg, and Cobalt - 0.1 mg.

* Calculated values.

C. Proximate analysis

At the end of 15th week of the experiment, one bird from each replicate were randomly selected, slaughtered, and breast samples were harvested for chemical analysis. Meat moisture content was determined by drying the samples in a hot air oven at 80°C for 40 hours. Estimation of crude protein by Kjeldahl method; ether extract using Soxhlet apparatus and ash content was determined by burning the samples in a muffle furnace at 600°C (AOAC, 1995).

D. Statistical analysis

Statistical analysis was carried out using SPSS-26 software for one way ANOVA and level of significance was measured using DUNCAN test following the procedure of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The results of proximate / nutrient composition in breast meat of male, female and overall birds of different treatment groups are presented in Table 2, 3 and 4, respectively.

A. Moisture

In this present study, significant difference in moisture level was observed in breast meat of male birds. The moisture per cent ranged from 71.27 % to 73.61 %. In T_5 group (3000 ME Kcal/Kg) showed significantly lowest moisture level (71.27%), other treatment groups did not differ significantly. Similar observation was reported in broilers, increasing dietary energy level lowered moisture level (72.78 %) of breast meat (Marcu e*t al*., 2013). Whereas, the dietary energy levels had no significant difference in moisture level of breast meat of female and overall Aseel chickens.

B. Crude protein

The increase in energy level of the diet had significant effect on crude protein per cent in breast meat of female groups. In T_5 group (3000 ME kcal/kg) recorded lowest protein level (22.57 %). Whereas, different energy diets had no significant effect on protein per cent in breast meat of male and overall Aseel chickens. The protein per cent in breast meat of male groups recorded between 23.81 and 25.64 per cent. Haunshi *et al*., (2013) reported similar level of crude protein content of 23.69 in Aseel chickens at 20 weeks of age. In earlier reports, crude protein per cent in broiler breast muscle was not influenced by dietary energy levels, although fat per cent was higher when feeding the low energy diets compared to high energy diets (Infante- Rodriguez *et al*., 2016).

C. Crude fat

In the present study the different energy levels of the diet had significant effect on crude fat per cent in breast meat of male, female and overall Aseel chicken. The reduction in energy level found that increased fat content of breast meat of Aseel chicken (Fig. 1). The highest fat level (1.41 %) recorded in T_2 group (2600 ME kcal/kg) of breast meat of female Aseel chicken. Similar findings were reported in broilers, reducing energy level lowered protein and increased fat content of broiler breast and thigh meats (Marcu *et al*., 2012). These results revealed that an increase in dietary energy level for Aseel chickens may not increase fat per cent of breast meat.

Table 2: Effect of varying levels of dietary energy on proximate composition (Mean ± S.E) in breast muscle of male Aseel native chicken at 15 weeks of age (per cent).

Nutrients %	T_1	T_2	T_3	T_4	T_5	P Value
	ME 2800	ME 2600	ME 2700	ME 2900	ME 3000	
	CP 21 %					
Moisture	$73.61^{b} \pm 0.41$	$73.01^{b} \pm 0.41$	$72.87^{b} \pm 0.41$	$72.46^{b} \pm 0.33$	$71.27^{a} \pm 0.37$	0.008
Crude Protein	24.50 ± 0.41	24.62 ± 0.45	25.64 ± 0.37	23.81 ± 0.45	24.93 ± 0.41	0.083
Crude fat	$0.99^{a} \pm 0.04$	$1.19^{c} \pm 0.04$	$1.10^{abc} \pm 0.04$	$1.01^{ab} \pm 0.04$	$1.13^{bc} \pm 0.04$	0.021
Total Ash	$1.26^{c} \pm 0.04$	$0.93^{a} \pm 0.04$	$1.10^{b} \pm 0.02$	$1.71^{d} \pm 0.08$	$1.37^{c} \pm 0.04$	0.001

Each value is mean of four observations.

Means with at least one common superscript in a row do not differ significantly (P< 0.05).

Table 3: Effect of varying levels of dietary energy on proximate composition (Mean ± S.E) in breast muscle of female Aseel native chicken at 15 weeks of age (per cent).

Nutrients %	T_1	T_2	T_3	T_4	T_5	P Value
	ME 2800	ME 2600	ME 2700	ME 2900	ME 3000	
	CP 21 %					
Moisture	70.94 ±0.41	72.02 ±0.41	72.37 ±0.53	72.27 ±0.49	72.49 ±0.49	0.182
Crude Protein	24.60^{b} ±0.37	24.73^{b} ±0.49	24.02^{b} ±0.42	24.38^{b} ±0.04	22.57^{a} ±0.04	0.002
Crude fat	1.09^{b} ±0.04	1.41^{c} ±0.04	0.93^{a} ±0.04	0.91^{a} ±0.02	0.92^{a} ±0.01	0.001
Total Ash	1.13^{b} ±0.05	1.51^{c} ±0.04	1.09^{ab} ±0.01	1.20^{b} ±0.04	0.99^{a} ±0.01	0.001

Each value is mean of four observations.

Means with at least one common superscript in a row do not differ significantly (P< 0.05).

In the same way, Abouelezz *et al*., (2019) reported in breast muscle of slow growing yellow feathers male chicken had higher fat per cent (1.64) in lower energy (2997 ME kg per kg) than higher energy diet (3236 kcal ME per kg).

D. Total Ash

Diets with varying dietary energy levels had significant effect on ash content in breast meat of male, female and overall Aseel chicken. The highest ash content of 1.71 % was recorded in T_4 group (2900 ME kcal/kg) of male breast meat whereas, T_2 group (2600 ME kcal/kg) recorded higher ash content (1.51 %) in female breast meat. Similar level of fat and ash content in Aseel chicken meat were reported by Rajkumar *et al*., (2017). The higher level of ash content in Aseel cross chickens indicating high mineral content in the meat (Souza *et al*., 2011).

Table 4: Effect of varying levels of dietary energy on nutrient composition (Mean ± S.E) in breast muscle of overall Aseel native chicken at 15 weeks of age (per cent).

Nutrients %	T_1	T_2	T_3	T_4	T_5	P Value
	ME 2800	ME 2600	ME 2700	ME 2900	ME 3000	
	CP 21 %					
Moisture	72.28 ± 0.57	72.52 ± 0.33	72.62 ± 0.32	72.37 ± 0.27	71.88 ± 0.37	0.704
Crude Protein	24.55 ± 0.25	24.68 ± 0.31	24.83 ± 0.40	24.10 ± 0.23	23.75 ± 0.48	0.188
Crude fat	1.04^a ± 0.03	1.30^b ± 0.05	1.02^a ± 0.09	0.96^a ± 0.03	1.03^a ± 0.04	0.001
Total Ash	1.20^a ± 0.04	1.22^a ± 0.11	1.10^a ± 0.01	1.46^b ± 0.11	1.18^a ± 0.07	0.034

Each value is mean of eight observations.

Means with at least one common superscript in a row do not differ significantly (P< 0.05).

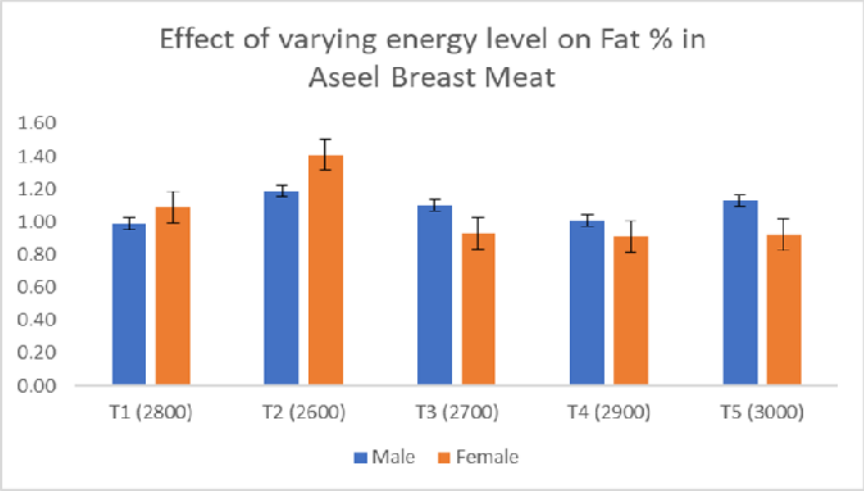

Fig. 1. Effect of varying energy level on fat per cent in Breast meat of Male and female Aseel chicken.

CONCLUSION

The varying energy diets had significant effect on fat and ash content in breast meat of Aseel chicken. The reduced fat per cent and increased ash content in breast meat was observed in T_4 (2900 ME kcal/kg) group of male chicken. The increased fat, protein per cent and ash content in breast meat was observed in T_2 (2600 ME kcal/kg) group of female Aseel chicken. These results indicating that an appropriate energy level may be chosen while formulating diet for male and female Aseel native chicken to enhance the nutritive value and quality of meat. Further studies are warranted on influence of various dietary nutrients on fatty acid profile, mineral content and other nutrient composition of native chicken meat.

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