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Effect of Substitution the Imported Concentrate by Plant Concentrate on Performance and Blood Chemistry of Broiler Chicks

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Abstract: The experiment was conducted to assess the nutritive value of faba bean (*Vicia faba* L.*var.minor*), cowpea (*Vigna unguiculata* L. Walp), pigeon pea (*Cajanus cajan* L. Millsp) and alfalfa meal (*Medicage Sativa*) as a plant concentrate to replace the imported concentrate for broiler diets. The plant concentrate was formulated from faba bean 42%, cowpea 29.98%, pigeon pea 15% and alfalfa meal 5%, lysine 0.8%, methionine 0.72%, calcium 6% and vitamin premix 0.5%, respectively. Two hundred unsexed broiler chicks (Cobb) were used. Four dietary treatments containing 0%, 5%, 10% and 15% plant concentrate were formulated to meet the nutrients requirements as outlined by NRC (1994). The experiment was in a Completely Randomize Design (CRD), 50 birds per treatment with five replication 10 bird/ replicate. The study lasted for six weeks. Parameters measured was feed intake, body weight gain, Feed Conversion Ratio (FCR), pre-slaughter weight, dressing percentage protein efficiency, some blood parameters (glucose, cholesterol, triglyceride, total lipid, total protein, calcium, inorganic phosphorus) and feed cost. Result indicated that dietary inclusion of plant concentrate had significantly ($p<0.05$) decreased feed intake, final body weight, serum cholesterol and profitability. Birds fed diet containing 5% plant concentrate show similar response to control group ($p>0.05$) on weight gain, feed conversion ratio, protein efficiency and dressing percentage. However, the dietary treatments had no significant effect ($p>0.05$) on blood serum glucose, triglyceride, total protein, total lipids, calcium and phosphorus respectively.

Key words: Alfalfa, broilers, cowpea, fababean, pigeon pea

INTRODUCTION

Faba bean (*Vicia faba*) is a legume grain an important source of protein, energy and minerals, it has been used in broiler diets (Cowieson *et al*., 2003; Farrell *et al*., 1999; Steenfeldt *et al*., 2003), broiler chicks fed diets containing faba bean indicated no adverse effect on live weight gain and feed efficiency (Sanz, 1963). Cowpeas (*Vigna unguiculata*) are low cost source of dietary protein and nutrient (Egounlety and Aworth, 2003). The chemical composition of cowpea was found to contain as percentage crude protein range (18.5-35.0), crude fat (0.7-3.5) and starch (31.5-48.0) (Chavan *et al*., 1989), lysine (6.6-8.1) and methionine (1.5-2.3) (Walker, 1981). Pigeon pea (*Cajanus cajan*) is useful in various ways as human food and animal feed. It has been found a satisfactory protein ingredient up to 30% of the whole diet for broilers (Amaefule-Ku and Obioha, 1998). Alfalfa meal (*Medicage sativa*) provides an excellent protein-rich food for cattle, horses, sheep and other animals (MacDonald *et al*., 1981).

The use of these legumes in poultry diets could be impaired by the presence of anti nutritional factors which limited there direct incorporation as protein source into poultry diets (Udedibie and Nwaiwu, 1987; Ologhobo, 1992; D'Mello, 1994). Anti nutritional factors have negative effects on digestion and performance of fowls (Ologhobo, 1992; D'Mello, 1994; Huiman, 1995; Beric *et al*., 1997). The presence of anti nutritional factors such as trypsin inhibitors and hemagglutinins in pigeon pea (*Cajanus cajan*) (Udedibie and Carlini, 2000) impede protein and energy utilization by monogastric animal like poultry, pigeon pea also contains some unavailable carbohydrates that reduce the bioavailability of other nutrients (Kamath and Belavady, 1980). There are many methods to improve the utilization of nutrients in legume seed such as decortications, dehulling, milling and other methods (Apichai, 2007). Dehulling removed 98% of the tannin content (Plahar *et al*., 1977) improved protein quality and digestibility (Bressani, 2002). The objective of this study was to evaluate the effect of different levels of plant concentrate formulate from decorticated faba bean, cowpea or pigeon pea in complete substitution of imported concentrate for broiler chicks.

MATERIALS AND METHODS

Experimental birds and design: 200 one day old unsexed broiler chicks (Cobb) were used for this study. The initial weight of the birds ranged 49.6-50.2 g. The

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Table 1: Percentage composition and calculated chemical analysis of the rations

	Treatments			
Feed staffs (%)	Control	T1	T2	T3
Sorghum	63.31	60.63	58.60	56.30
Groundnut meal	16.70	17.61	17.86	15.31
Sesame meal	12.80	12.93	09.70	9.50
Imported concentrate*	05.00	00.00	00.00	00.00
Plant concentrate**	00.00	05.00	10.00	15.00
Di-calcium phosphate	01.50	02.05	01.75	01.20
Salt	00.20	00.20	00.20	00.20
Premix***	00.20	00.20	00.20	00.20
Lysine	00.09	00.35	00.06	00.00
Methionine	00.00	00.10	00.03	00.00
Vegetable oil	00.20	00.93	01.60	02.29
Calculated analysis				
ME kcal/kg diet	3101.40	3101.07	3101.41	3101.69
Crude protein (%)	22.57	22.57	22.57	22.57
Crude fiber (%)	04.34	04.66	04.75	04.81
Calcium (%)	01.28	01.29	01.27	01.20
Total phosphorus (%)	00.67	00.53	00.60	00.68
Lysine (%)	01.11	01.13	01.11	01.33
Methionine (%)	00.51	00.53	00.52	00.57

Imported concentrate* contains (%): CP 32, CF 2, Ca 7, P 5, lysine 11, methionine 3.7 and ME 1900 kcal/kg.

Plant concentrate** contains (%): CP 29.3, CF 8, Ca 3.4, P 2, lysine 6, methionine 2 and ME 1880 kcal/kg.

Premix*** provided per kg of diets vitamin A 8000 IU, vitamin D3 1400 IU, vitamin E 2IU, vitamin K3 2 mg, vitamin B2 4 mg, Vitamin B1 2 mg, Ca-d-pantothenate 5 mg, nicotin amide 15 mg, choline choride 100 mg, folic acid 0.5 mg, vitamin B12 5 mcg, Iron 22 mg, manganese 33 mg, copper 2.2 mg, cobalt 0.5 mg, zinc 25 mg, Iodine 1.1 mg

birds were fed control broiler starter diet for three days (adaptation period). The chicks were randomly assigned to the four experimental diets, 50 birds per treatment group in a completely randomized design; each treatment group was further subdivided into five replicates of 10 birds.

Experimental diets: The experimental diets were calculated to meet the nutrient requirement of broiler chicks according to the National Research Council (1994). Four iso energetic and iso nitrogenous diets were formulated with graded levels of plant concentrate 0, 5, 10 and 15%. The control diet (0%) contained 5% imported concentrate. The compositions and the proximate constituents of experimental diets are shown in Table 1.

Management and data collection: The chicks were reared in deep litter with feed and water supplied *ad-libitum*. Each pen was provided with bulb lamb (60 watts) for continuous lightening throughout experimental period, artificial light was provided by lambs 12 h in the evening and 12 h natural day-light. The birds were vaccinated against Newcastle disease at 14 day-old (IB) and at the 28 day (lasota). Gumboro disease vaccine was given at the 21 day. Vitamins offered as supportive dose before and after vaccination. They were also given antibiotics. Measurements taken were feed intake, weight gain and feed conversion ratio. At the end of the experimental period 2 birds from each replicate of each dietary treatment were randomly selected and weighted individually then slaughtered and allowed to bleed. Samples of blood were collected into clean dry test tubes and allowed to clot and serum was separated and collected for frozen and later analyzed. Hot carcasses weight was recorded and the dressing percentage was determined by expressing hot carcass weight to the live weight. Protein Efficiency Ratio (PER) calculated as weight gain divided by protein intake.

Statistical analysis: The data collected were subjected to analysis of variance and the means were separated using Duncan's Multiple Range Test as described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The performance data of broiler chicks fed diets containing different levels of plant concentrate which including faba bean, cowpea, pigeon pea and alfalfa meal are presented in Table 2. Increasing plant concentrate level from 5-15% significantly ($p<0.05$) decreased feed intake. Robinson and Singh (2001) reported a similar effect when increased the level of grain legume seeds in broiler rations. In the current study no significant difference ($p>0.05$) was observed in the weight gain of birds fed 5% plant concentrate and that fed 5% imported concentrate, however, birds fed 15% plant concentrate had the least weight gain. Moreover, final body weight at point of slaughter significantly decreased ($p<0.05$) by increasing level of plant concentrate, this result related to the lower feed consumption thus leading to a deficiency in essential amino acids, in addition to imbalances of these amino acids in plant protein compared with amino acids in control group which contributed by animal protein, this feature could also be attributed to the influence of a high concentration of anti nutritional factors as phytic acid inhibits the absorption of calcium and phosphorus through the small intestine (Flaih *et al*., 1998).

The birds fed 5% plant concentrate obtained similar feed efficiency (2.35 g/bird) to the control (5% imported concentrate) group (2.39 g/bird), however, the feed conversion ratio FCR was found to be poor in birds fed 10 and 15% plant concentrate this result may be related to the presence of β-gleans and xylans in the seed hulls of legumes (Choct, 1997) β-glucan and xylans brings very low viscous condition in the small intestine of birds whereby they interfere with nutrient absorption (Onilude and Osho, 1999). The birds fed 5% plant concentrate recorded the highest dressing carcass percentage (69.79%) than control group (67.63) while the lowest

Table 2: Effect of feeding plant concentrate on overall performance of broiler chicks

	Plant concentrate levels				
Items	0%	5%	10%	15%	±SEM
Total feed intake g/bird	3532.41[a]	3325.49[b]	3298.06[b]	3278.75[b]	45.41
Total weight gain g/bird	1480.73[a]	1420.46[a]	1057.48[b]	978.47[b]	33.24
Final weight g/bird	1531.33[a]	1471.56[b]	1105.14[c]	1027.57[d]	23.01
Feed conversion ratio	2.39[c]	2.35[c]	3.12[b]	3.36[a]	0.39
Dressing percentage	67.63[ab]	69.79[a]	64.87[ab]	63.79[b]	1.84
Protein efficiency ratio	1.90[a]	1.93[a]	1.44[b]	1.34[c]	0.03

Table 3: Effect of feeding plant concentrate on serum composition of broiler chicks

	Plant concentrate levels				
Items	0%	5%	10%	15%	±SEM
Glucose	175.98	165.78	186.30	165.09	11.62
Cholesterol	95.61[a]	64.32[ab]	45.61[b]	64.90[ab]	12.82
Triglyceride	392.68	392.20	415.09	405.83	35.96
Total proteins	3.95	2.83	3.08	3.25	0.89
Total lipids	488.29	456.52	460.70	470.73	37.41
Calcium	10.32	14.05	12.21	12.54	1.32
Phosphorus	7.94	7.11	7.19	7.98	0.51

Table 4: The feeding economics of experimental birds

	Plant concentrate levels				
Items	0%	5%	10%	15%	±SEM
Feed cost/bird (SDG)	4.110[c]	3.915[d]	4.274[b]	4.961[a]	0.04
Average weight of bird (kg)	1.531[a]	1.472[b]	1.105[c]	1.028[d]	0.02
Total returns (SDG)	13.779[a]	13.257[b]	9.945[c]	9.252[d]	0.47
Total cost/bird (SDG)	7.385[c]	7.190[d]	7.549[b]	7.966[a]	0.07
Net profit/bird (SDG)	6.394[a]	6.067[b]	2.396[c]	1.286[d]	0.31

*SDG: Sudanese pounds (1$ = 3SDG)

percentage of carcass dressing were observed by birds fed 15% plant concentrate (63.79%) The PER was similar between the group fed 5% plant concentrate and control group, however, it significantly ($p<0.05$) decreased by increasing the level of plant concentrate, this result may be due to insufficient amount of essential amino acids in legume seeds that affected the protein synthesis (Ene-Obong, 1995).

The results of serum components are presented in Table 3. The results observed a significant difference ($p<0.05$) on serum cholesterol, the lowest level was obtained in birds fed 10% plant concentrate, extracts from alfalfa meal seeds, leaves and roots might be helpful for lowering cholesterol levels, thereby reducing atherosclerosis plaques (Esper *et al*., 1987; Colodny *et al*., 2001), while the highest level was found in birds fed on control diets. However, there was no significant effect was observed for the blood serum glucose, triglyceride, total protein, total lipids, calcium and phosphorus.

Data presented in Table 4 illustrates the feed economics of experimental diets. The lowest feed cost at the point of slaughter was observed on birds fed 5% plant concentrate (3.92SDG) then control group (4.11SDG), 10% (4.27SDG) respectively, whereas a higher feed cost was observed on birds fed 15% plant concentrate (4.96SDG) which could be increased the cost of production. In the current study the control group and diet contain 5% plant concentrate are more benefit to feeding broiler chicks. It is recommended to use diet contain 5% plant concentrate to replace the imported concentrate to reduce production cost.

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