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Inclusion of Some Dehulled Legume Grains as Broiler Chicks Concentrates

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Abstract: The objective of this study was to evaluate feeding plant concentrate (containing dehulled Faba bean, Cowpea and pigeon pea) substituting the imported concentrate for broiler chicks' performance and blood parameters. Two hundred one-day old broiler chicks were divided into 4 groups of 50 birds in a completely randomize design (CRD) with five replicate (10 birds/replicate). Four experimental diets containing 0%, 5%, 7% and 9% plant concentrate were formulated to meet the nutrients requirements as outlined by NRC (1994). 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 and profitability. Result revealed that overall feed intake was not significantly ($p>0.05$) influenced by the dietary inclusion of plant concentrate. Increasing dietary level of plant concentrate had significantly ($p<0.05$) decreased weight gain and final body weight, while birds fed diet containing 5% plant concentrate observed similar ($p>0.05$) performance to the control group. There was no significant ($p>0.05$) difference on serum glucose, cholesterol, triglyceride, total lipids and total proteins, calcium and phosphorus. Birds fed 5% plant concentrate recorded similar ($p>0.05$) profit to that on control group.

Key words: Broilers, concentrate, performance dehulled legume

INTRODUCTION

The unavailability of animal protein and inadequate quantities, have forced animal nutritionists to exploit alternative sources of protein from legumes in lieu of expensive and scarce animal protein. This makes the use of protein rich legumes to be essential alternatives in poultry nutrition (Akanji, 2002). Legumes protein contributes the best alternative according to their high nutritive value. However, the presence of anti-nutritional factors in the seed and meal of legumes decrease the availability of these nutrients. Various methods for food processing and preparations such as de-hulling significantly increased protein content and greatly reduced condensed tannin and polyphenol levels in faba bean (Alonso *et al*., 1999). Detoxification, soaking, roasting, boiling, germination and fermentation, which could be easy and affordable to both rural and small-scale poultry producers (Lambourne and Wood, 1985; Deka and Sarkar, 1990), Mechanical and heat treatments or enzymes mixtures additives in order to inactivate or reduce the effect of anti-nutrients factors (Barbour *et al*., 2001; Farran *et al*., 2001). Plant concentrate composed from raw legume grains (raw cowpea, faba bean and pigeon pea) containing high concentration of anti nutritional factors which reduced feed intake and decreased weight gain of broiler chicks by increasing the levels of plant concentrate in the diet (Dousa *et al*., 2011). Weight gain of chicks fed diets containing 75% autoclaved faba bean increased by 4 or 8% compared with that fed raw beans (Ernest, 1984). De-hulling removed 98% of the tannin content of raw cowpea seed (Plahar *et al*., 1997). Price *et al*. (1980) claimed that soaking of pigeon pea seeds reduced trypsin inhibitory effect and improved *in vitro* protein and starch digestibility. Therefore, the objective of this experiment was to evaluate feeding graded levels of de-hulled faba bean, cowpea or pigeon pea as plant concentrate substituting the imported concentrate for broiler chicks and to assess the economic aspects of experimental diets.

MATERIALS AND METHODS

Experimental birds and design: Two hundred one day old unsexed commercial broiler chicks (Cobb) were used for this study. The initial weight of the birds was 47.9 g. The 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 with five replicate (10 birds/replicate) in a completely randomized design.

Experimental diets: Plant concentrate contained dehulled faba bean, cowpea and pigeon pea, lysine, methionine and calcium (Table 1). Four diets were

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Table 1: Composition and proximate analysis of experimental concentrate

Items	%
Faba beans	43.00
Cowpeas	30.00
Pigeon peas	20.00
Lysine	0.60
Methionine	0.65
Calcium	5.25
Premix	0.50
Proximate analysis	
Dry matter	94.65
Crude protein	28.16
Crude fiber	12.14
Ether extract	4.93
Ash	8.28
NFE	41.14
ME	2539.34

Metabolizable Energy (ME) calculated according to the equation of Lodhi *et al*. (1976)

Table 2: Composition of experimental broiler starter diets containing graded levels of plant concentrate

	Levels of plant concentrate %			
Feed staffs %	0	5	7	9
Sorghum	63.22	61.10	60.54	59.27
Groundnut meal	17.50	18.26	18.00	18.50
Sesame meal	12.79	12.90	11.89	10.32
*Super concentrate	5.00	0.00	0.00	0.00
**Plant concentrate	0.00	5.00	7.00	9.00
Di-calcium phosphate	0.18	0.58	0.30	0.30
Limestone	0.82	1.00	1.07	1.04
Salt	0.20	0.20	0.20	0.20
***Premix	0.20	0.20	0.20	0.20
Lysine	0.09	0.19	0.04	0.00
Vegetable oil	0.00	0.57	0.76	0.17
Calculated analysis				
ME kcal/kg diet	3102.30	3102.20	3102.00	3102.10
Crude protein (%)	22.91	22.91	22.90	22.90
Crude fiber (%)	4.42	4.70	4.72	4.76
Calcium (%)	1.10	1.01	1.00	1.00
Total phosphorus (%)	0.70	0.63	0.61	0.63
Lysine (%)	1.12	1.10	1.11	1.23
Methionine (%)	0.51	0.50	0.55	0.60

*Contains (%): CP 32, CF 2, Ca 7, P 5, Lysine 11, Methionine 3.7 and ME 1900 kcal/kg.

**Contains (%): CP 30, CF 7.2, Ca 2.1, P 2.2, Lysine 8.6, Methionine 3.4 and ME 1875.4 kcal/kg.

***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

formulated to meet the nutrient requirement of broiler chicks according to the National Research Council (1994). Diets were iso energetic and iso nitrogenous with graded levels of plant concentrate 0, 5, 7 and 9%. The control diet contained 5% imported concentrate. The compositions and the proximate constituents of experimental diets are shown in Table 2 and 3.

Table 3: Composition of experimental broiler finisher diets containing graded levels of plant concentrate

	Levels of plant concentrate %			
Feed staffs %	0	5	7	9
Sorghum	64.69	62.21	61.46	60.37
Groundnut meal	16.90	17.50	17.18	17.25
Sesame meal	12.00	12.37	11.50	10.32
Super concentrate	5.00	0.00	0.00	0.00
Plant concentrate	0.00	5.00	7.00	9.00
Di-calcium phosphate	0.11	0.53	0.38	0.26
Limestone	0.80	1.09	1.11	1.13
Salt	0.20	0.20	0.20	0.20
Premix	0.20	0.20	0.20	0.20
Lysine	0.10	0.21	0.05	0.00
Methionine	0.00	0.01	0.00	0.00
Vegetable oil	0.00	0.68	0.92	1.27
Calculated analysis				
ME kcal/kg diet	3114.40	3114.50	3114.40	3114.40
Crude protein %	22.51	22.50	22.50	22.50
Crude fiber %	4.33	4.61	4.64	4.66
Calcium %	1.06	1.02	1.02	1.02
Total phosphorus %	0.68	0.61	0.61	0.62
Lysine %	1.11	1.11	1.11	1.22
Methionine %	0.50	0.50	0.55	0.60

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 hrs in the evening and 12 hrs natural day-light. The birds were vaccinated against Newcastle disease at 7 day-old (IB) and at the 28 day (lasota). Gumboro disease vaccine was given at the 21 day. Measurements taken were feed intake, weight gain and feed conversion ratio. At the end of the experimental period two 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 analysis. 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 total protein intake.

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

RESULTS

The results of overall performance of broiler chicks as affected by inclusion of different levels of plant concentrate are presented in Table 4. Overall feed intake was not significantly ($p>0.05$) influenced by the dietary inclusion of plant concentrate. Overall body weight gain significantly ($p<0.05$) affected by the dietary inclusion of plant concentrate. Birds fed 5% plant concentrate

Table 4: Effect of dietary levels of plant concentrate on overall performance of broiler chicks

	Treatments				
	Plant concentrate levels %				
Items	0	5	7	9	±SEM
Feed intake (g/bird)	3603.47	3603.42	3484.24	3400.63	136.20
Body weight gain (g/bird)	1446.68^{a}	1386.43^{ab}	1192.58^{c}	1279.62^{bc}	42.55
Final weight (g/bird)	1497.40^{a}	1426.05^{ab}	1242.10^{c}	1331.01^{bc}	40.38
FCR (g feed/g gain)	2.49^{b}	2.60^{b}	2.93^{a}	2.66^{b}	0.08
PER (weight gain/protein intake)	1.87^{a}	1.77^{ab}	1.55^{c}	1.70^{bc}	0.08

^{abcd}Means with different superscripts in the same row were significantly different ($p \leq 0.05$). Values are means of 5 replicates per treatment

Table 5: Effect of dietary levels of plant concentrate on serum constituents of broiler chicks

	Treatments				
	Plant concentrate levels %				
Items	0	5	7	9	±SEM
Glucose (mg/dl)	242.40	229.80	226.60	229.80	9.31
Cholesterol (mg/dl)	115.00^{a}	104.40^{ab}	108.00^{a}	95.00^{b}	3.41
Triglyceride (mg/dl)	34.12	26.44	30.08	32.24	2.49
Total lipid (mg/g)	149.12^{a}	130.84^{b}	138.08^{ab}	127.24^{b}	4.14
Total protein (g/dl)	3.32	2.62	2.78	2.32	0.31
Calcium (mg/dl)	5.38	5.42	5.32	5.16	0.53
Phosphorus (mg/dl)	6.70^{a}	5.16^{b}	6.66^{a}	6.34^{ab}	0.42

^{ab}Means with different superscripts in the same row were significantly different ($p \leq 0.05$)

Table 6: Effect of dietary levels of plant concentrate on feed cost and profitability of broiler chicks

Diets	Plant concentrate levels	Cost of feed (SDG)	Cost of produce (SDG)	Return (SDG)	Profit (SDG)	Profit (%)
A	0%	4.07	7.87	15.18	7.31	48.02
B	5%	3.97	7.77	14.55	6.78	46.49
C	7%	3.98	7.78	12.52	4.74	37.69
D	9%	4.09	7.89	13.43	5.55	41.16
Difference between A and B		0.10	0.10	0.63	0.53	1.53
Critical Value (CV)		0.47	0.47	1.34	1.11	4.21
Standard Error (±SE)		0.22	0.22	0.63	0.52	1.99

Values are means of 5 replicates per treatment. SDG (Sudanese pounds)

showed similar weight to the control, birds fed 9% plant concentrate showed similar weight to the birds fed 7% plant concentrate and less than control. Overall feed conversion ratio was significantly ($p<0.05$) influenced by dietary treatment. Birds received 7% plant concentrate observed to have significantly ($p<0.05$) higher FCR compared to other treatment which recorded similar ($p>0.05$) values of FCR. Overall protein efficiency ratio was significantly ($p<0.05$) affected by dietary inclusion of plant concentrate. Birds fed on control and diet contained 5% plant concentrate was significantly ($p<0.05$) higher PER compared to that of others group. PER of birds fed diet contained 5 and 9% plant concentrate was significantly ($p<0.05$) better than those fed on 7% plant concentrate.

Results of broiler serum analysis indicated that there was no significant ($p>0.05$) effect of dietary treatments on serum glucose, cholesterol, triglyceride, total lipids and total proteins, calcium and phosphorus (Table 5). The feed cost and profitability are demonstrated in Table 6. Birds fed 5% plant concentrate obtained similar cost and profit to the control. Whereas those birds fed 7 and 9% plant concentrate recorded the least profit, while the fed cost of these groups was similar to the control.

DISCUSSION

Regarding the effect of dietary inclusion of plant concentrate on overall performance, feed intake was not significantly different between the treatments. The adequate feed consumption of all tested groups may be related to the removal of tannins and other polyphenolic compounds as result of de-hulling process and confirms that the energy was balanced and adequate intake for all treatments and the palatability was not influenced by the processing methods. Body weight gain and live body weight of chicks were effect by the dietary treatments. Body weight gain and live body weight were significantly reduced as the proportion of plant concentrate increased in the broilers diet. Birds fed 5% plant concentrate showed similar body weight gain to that on control groups. This finding agree with that obtained by Scott *et al.* (1982) and coincided with findings Sethi and Kulkami (1995).

Feed conversion ratio was influenced by dietary treatments. FCR of birds fed on control and diet contained 5% plant concentrate were similar and better followed by 9% plant concentrate. However, birds received 7% plant concentrate recorded the poorest FCR. This finding disagreed with that reviewed by Brisson *et al*. (1950) and Sanz (1963), they noticed that no adverse effect on FCR when broiler chicks were fed rations containing faba beans. Whereas the current result is in line with finding of Campbell and Marquardt (1977), they related the decrease in FCR with increasing in faba bean inclusion in broiler chick diets. Protein efficiency ratio was effect by dietary treatments. PER was depressed by increasing the level of plant concentrate in diet. PER of birds consumed diet contained 5% plant concentrate and control was significantly higher compared to other groups. The better improvement in the PER of broiler chicks fed diet contained cowpea seeds coincided with findings of Tshorhote *et al*. (2003), who attributed the improvement of PER to the quality of dietary protein which enhanced as result of the combination of more than one source of protein.

Result regarding the effect of dietary treatment on serum constituents, glucose, cholesterol, triglyceride, total lipid, total protein, calcium and phosphorus were not significantly affected by the dietary treatments. Feed cost was not significantly affected by the treatments. Whilst, birds consumed 5% plant concentrate and control diets observed higher profit compared to others. These results attributed to the lower body weight gain of chicks that obtained from those dietary treatments which supplemented with legume seeds that resulted from lower feed consumption of birds. This is in line with findings of Scott *et al*. (1982).

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