Nutritional Evaluation of Graded Levels of Pigeon Pea (Cajanus cajan) Seed Meal on Growth Performance and Blood Chemistry of Broiler Starter Birds

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Abstract

An experiment was carried out to investigate the dietary effects of toasted pigeon pea seed meal on growth performance and blood biochemical indices of broiler starters. One hundred and forty four day old broiler chicks were randomly divided into four experimental groups with 3 replicates of 12 birds per replicate. Four diets designated as T1, T2, T3 and T4 were formulated to contain 0%, 10%, 20% and 30% inclusion levels of toasted pigeon pea seed meal respectively. The four treatment groups were assigned the four experimental diets in a Completely Randomized Design (CRD) and fed the experimental diets for 28 days. Data was collected on weight gain, feed intake, feed conversion ratio, total protein, urea, creatinine and cholesterol and statistically analyzed. Results showed that there were significant differences (P<0.05) among treatments in average daily weight gain, average daily feed intake and feed conversion ratio. Average daily feed intake, daily weight gain and feed conversion ratio was best at T3 (82.33g/day, 32.54g/day and 2.53 respectively) and declined at T4 30% (75g/day, 27.25g/day and 2.77 respectively) inclusion level of toasted pigeon pea seed meal. However, there were no significant differences (p>0.05) for urea, creatinine and cholesterol. Total protein differed (P<0.05) significantly with T1 having the lowest value of 3.89mg/dl and T4 the highest value of 4.50mg/dl. From the results, it could be concluded that toasted pigeon pea seed meal could be best utilized at 20% dietary inclusion in broiler starters without any detrimental effect on growth performance and serum biochemistry.

Keywords: *broilers, pigeon pea, performance, serum chemistry and alternative protein source*

INTRODUCTION

Broiler farming plays a vital role in agricultural economy both in the developed and developing countries. Broiler supplies high quality animal protein for human consumption. This could be attributed to its short generation interval (6 – 12 weeks), fast growth rate, efficient feed utilization, good meat quality and quick return on investment. The broiler industry is faced with high cost and competition between man and animal for conventional feed resources which have led to astronomical increase in the cost of producing broilers. This requires intensification of research into cheaper alternatives that would support a commensurate performance of the birds. The use of pigeon pea (*Cajanus cajan*) seed could be considered in this respect as a cheaper alternative protein resource.

Pigeon pea is well produced in the south eastern [1] and central parts [2] of Nigeria. The legume grain has very low human food preference as it takes longer to be cooked, not well palatable compared to cowpea due to its acid taste and has no known industrial use for now [3]. The seeds are considered nonconventional poultry feed resource that can avail an option or protein substitute in poultry nutrition. Pigeon pea could provide nutritional importance as a protein source due to its relative high crude protein (CP) value ranging from 12 to 32% [4] and appreciable amounts of essential amino acids. [5] reported lysine 1.66%, methionine 0.29%, cysteine 0.29%, arginine 1.59% and tryptophan 0.11% in pigeon pea seed. However, the use of pigeon pea seed in poultry diets is limited by the presence of several antinutrients including haemagglutinin, trypsin inhibitor, chymotrypsin inhibitor, oxalate, amylase inhibitor, saponins, cyanide, phytic acid and tannins [6], and [7]. The removal of these metabolites becomes important for pigeon pea seed to be well utilized in broiler diet. The beneficial effects of feed heat processing in reducing the anti-nutritional factors in legume seeds are well documented [4] and [8].

This study therefore examined the effect of toasted pigeon pea on the growth performance and serum biochemical profile of broiler starters.

MATERIALS AND METHODS

Location of the experiment

The experiment was carried out at the poultry Unit of Federal College of Agriculture, Ishiagu, Ivo Local Government Area, Ebonyi state, Nigeria is situated at latitude 5.56^0N and longitude 7.31^0E, with an average rainfall of 1653mm and a prevailing temperature condition of 28.50^0c and relative humidity of about 80%.

Experimental diets

Whole pigeon pea seeds used for this experiment were sourced from Enugu, Enugu State, Nigeria. The seeds were toasted for sixty minutes at a temperature of 70°C and they were considered properly done when there was a change in the colour of the cotyledon, ranges from bright yellowish brown to dull yellowish brown. Afterwards, they were cooled, milled and used in the formulation of the experimental diets. Four diets designated as T1, T2, T3 and T4 were formulated to meet the nutrient requirements of broiler birds according to [9]. T1 contained 0%, T2, contained 10%, T3 contained 20% and T4 contained 30% graded levels of toasted pigeon pea seed meal as presented in Table 1.

Table 1: composition of experimental diets

	Dietary level			
Ingredients	**T1 0%**	**T2 10%**	**T3 20%**	**T4 30%**
Maize	52.00	52.00	52.00	52.00
Toasted pigeon pea seed meal	0.00	10.00	20.00	30.00
Soybean meal	35.00	25.00	15.00	5.00
Wheat offal	6.00	6.00	6.00	6.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25
Vitamin/mineral/premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100	100	100	100
Analyzed				
Dry matter	91.81	92.62	92.36	92.45
Crude protein	20.70	21.90	21.40	21.70
Crude fibre	7.30	7.80	7.60	7.80
Ash	10.32	10.53	10.31	10.62
Ether extract	5. 3	5. 7	6. 0	5. 8
Nitrogen free extract	51.81	50.55	42.26	47.81

Experimental birds

One hundred and forty four (144) day old broiler chicks were randomly divided into 4 experimental groups with 3 replicates of 12 birds per each. The four treatment groups were assigned the four experimental diets in a

Completely Randomized Design (CRD) and fed the experimental diets for 28 days. Before the arrival of the birds, the pens were swept, washed, disinfected and allowed to dry. Wood shavings were spread on the floor and the brooder lighted up to ensure adequate heat before the arrival the chicks. Feed and water were supplied *ad libitum*. Feed offered and refusals were recorded on a daily basis. Average initial weights of the birds were taken at the beginning of the trial and weekly subsequently.

Serum biochemical studies

Blood samples (4 ml) were drawn from the birds on the last day of the study. The birds were bled through the marginal wing vein and used for serum biochemical studies. The blood was allowed to clot at room temperature and serum separated by centrifuging within three hours of collection. Serum biochemistry parameters were measured using Bayer DCA 2000+ HbA1c analyzer.

Proximate analysis

All feeds and experimental material were analyzed for proximate compositions using the method of Association of the Official Chemist [10].

Statistical analysis

The results were analyzed using the Special Package for Social Sciences Window 17.0. One -way analysis of variance (ANOVA) was employed to determine the means and standard error. Treatment means were compared using Duncan's new multiple range test [11].

RESULTS AND DISCUSSION

Growth performance

The growth performance of the broiler starters fed graded levels of toasted pigeon pea seed meal diets are presented in Table 2. The feed intake of chicks declined ($P<0.05$) at the 30% level of toasted pigeon pea seed meal inclusion in the diet. This finding is in agreement with those of [12] and [4] for birds fed roasted and cooked pigeon pea seed meal diets respectively. This may probably explain the observed depression in feed intake. [13] reported that the acid taste of the pigeon pea seed coat affects the palatability of the meal.

Total weight gains were influence ($P<0.05$) by the treatment diets with T3 and T1 having the highest and lowest values respectively. The total weight gain of this study ranged (752.75 – 911.16g). This is however higher than the range of values (516 –572.2g and 434.52 – 590.76g) reported by [14] and [15] for broiler starters. The total weight gain recorded the highest value for the bird on 20% pigeon seed meal with a corresponding lowest value for the control treatment group. The result of this study is in dis agreement with those reported by [12] who observed slight but consistent decrease in weight gain with increasing levels of pigeon pea seed meal. The decrease in weight gain of T1 and T4 in relation to T2 and T3 of the chicks could be attributed to lower feed intake observed in the respective treatment groups. The metabolic and production requirements of the chicks could not be satisfied as the level of pigeon pea seed meal in the diet increased with the resultant decline in feed intake at 30% level of inclusion. Growth depression had earlier been attributed to reduced feed intake [16].

Feed conversion ratio differed ($p<0.05$) significantly, with T3 having the best value (2.53). T3 had the least feed conversion ratio indicating a better feed conversion ratio. The superior feed efficiency of diets T3 over the other diets is a reflection of the observed higher feed utilization and indeed higher growth rates of birds fed the respective diets.

Table 2: Growth performance of the broiler starters fed graded levels of toasted pigeon pea seed meal diet

	Dietary levels				
PARAMETERS	**T1 0%**	**T2 10%**	**T3 20%**	**T4 30%**	**SEM**
Initial body weight (g)	57.45	58.00	56.84	58.52	3. 22
Final weight (g)	810.20[b]	890.50[b]	968.00[a]	821.52[a]	13.24
Total weight gain (g)	752.75[d]	832.50[c]	911.16[a]	763.00[a]	11.65
Daily weight gain (g/day)	26.88[c]	29.73[b]	32.54[a]	27.25[c]	2.69
Total feed intake (g)	2125. 75[c]	2215. 50[b]	2305.10[a]	2110.00[c]	24. 87
Average daily feed intake (g/day)	75.92[c]	79.13[b]	82.33[a]	75.36[a]	4.11
Feed conversion ratio	2.82[a]	2.66[b]	2.53[c]	2.77[b]	1.27

[a. b.] *Means within the same row with different superscripts are significantly different (p<0.05)*

Serum biochemistry

The results of the serum biochemical indices are presented in Table 3. Total protein showed significant (P<0.05) difference with birds on 10% and 30% inclusions showing higher values. This agrees with the findings of [17] who reported serum protein for broilers ranging between 3.0 and 4.08. The results also fall within the reference range of 3.0 – 4.9 as reported by [18]. These showed that pigeon pea seed meal diets were well utilized by the broilers at relatively higher dietary inclusion. [19] reported serum protein as a source of replacement of tissue proteins, buffer in acid-base balance and as transporter of constituents of blood such as vitamins, iron, copper, hormones, lipids and enzymes.

Table 3: serum biochemistry of the broiler starters fed graded levels of toasted pigeon pea seed meal diet

	Dietary levels				
PARAMETERS	**T1**	**T2**	**T3**	**T4**	**SEM**
Total protein (mg/dl)	3. 89[b]	4.20[a]	4.00[b]	4.50[a]	0.14
Urea (mg/dl)	8.40	8.90	9.00	9.90	0.29
Creatinine (mg/dl)	0.82	0.88	0.86	0.74	0.09
Cholesterol (mg/dl)	137.39	136.32	135.41	133.12	4.38

[a. b.] *Means within the same row with different superscripts are significantly different (p<0.05)*

CONCLUSION

The results obtained in this study strongly indicate that up to 20% toasted pigeon pea seed meal may be incorporated into diets of broiler starters without any deleterious effect on growth performance and serum biochemical indices.

Ethics approval

This paper followed all the guidelines for the care and use of laboratory animal model of the Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria.

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