Effect of Feeding Pigeon Pea (*Cajanus cajan*) Seed Meal on Nutrients Intake and Growth Performances of Broiler Chicken Breeds

Solomon Tiruneh Ali[1], Molla B.[1], Abto A.[1], Asres Z.[1], Liuel Y.[1], Mesifen L.[2]

[1]*Sirinka Agricultural Research Center*
[2]*Amhara Agricultural Research Institute*

Abstract
The study was conducted to evaluate locally available feed ingredient for broiler breed, in 2017. For this study a total of 300 day-old chicks Cobb 500 strains of broiler chicks were initially raised together for one week in a brooding house. At the end of the brooding period (1 week), 285 chicks were randomly distributed into 15 pens equally; representing 5 feeding treatments to evaluate the performance of chicks fed varying dietary levels of pigeon pea seed meal (PSM) replacing soybean meal (SBM) up to the age of 56 days. Treatments were inclusion of PSM at 0 (T1), 5 (T2), 10 (T3), 15 (T4) and 20% (T5). Two birds were randomly selected from each replication for carcass evaluation at the end of the study. The crude protein content of PSM was 21%. Daily dry matter (DM) intake during the entire experimental period ranged 87.73 to 100.31 g/bird and greater value were recorded at T4 than T5 and T2. Daily body weight gain for the entire experimental period were 36.01, 35.76, 37.51, 34.96 and 36.02 g for T1, T2, T3, T4 and T5, respectively and values were greater for T3 as compared to T1, T2, T 4 and T 5. Replacement of PSM for SBM lowered yield of most parameters such as dressed weight, eviscerated weight, breast weight, thigh weight and drumstick weight. Depending on the production parameters measured, PSM can be substituted to SBM in broilers diet up to a level of 20% inclusion in the total ration without negative effect on biological performance and did not have any adverse effect on the health of birds, indicating the potential of the plant as an alternative feed ingredient in poultry feeding.

Keywords: Dry matter intake, inclusion, Pigeon pea, weight gain

1. Introduction

Ethiopia is believed to have the largest livestock population in Africa. The recent poultry population census [1] shows that Ethiopia has about 60.5 million poultry. This sector has been contributing considerable portion to the economy of the country by providing food, cash income, promoting saving, social functions and employment. Besides, chicken production in the urban peri-urban areas contributes to employment opportunity for the youth, elders, women and sick.

* Corresponding author: Solomon Tiruneh Ali
Email: solali17@yahoo.com

Pigeon pea (*Cajanus cajan*) is an important grain legume commonly grown and consumed in tropical and subtropical regions of the world. Pigeon pea contains a high level of crude protein ranges from 21-30% [2]. This provides the best source of feed for livestock in addition to manufacture of the byproduct. Pigeon pea was found to contain as percentage Crud Protein (22-27), Crud Fiber (7.3-10), NFE (61.2), Fat (1.7-2.1), Ash (3.1-4.2), Lysine about 7.59 [2]. Amino acid availability was 82.33% with low content of sulphur amino acids especially Cystine and Methionine.

Moreover, pigeon pea is a good source of soluble vitamins especially Thiamin, Riboflavin, Niacin and Choline. The Metabolizable Energy (ME) content was 11.1 Mj/kg in the raw and 12.0 Mj/kg

in the toasted seed meal. Anti-nutritional factors in Nigerian pigeon pea seed include trypsin inhibitor activity, tannins and phytases.

Inclusion of 10% processed pigeon pea seeds had no significant effects on feed intake, weight gain, feed conversion ratio, final live body weight, hot carcass weight and dressing percentage. On the other hand, Broiler Chicks could be fed 25% *Cajanus cajan* seed meal (CCSM) in the diet as raw, toasted, boiled or soaked *Cajanus cajan* seed meal (CCSM) without any adverse effect on the performance of the broiler chicks.

In the same manner, inclusion of roasted PSM can be included in broiler starter and finisher diets at 26% and 27% levels, respectively without any adverse effect on broiler birds. At such levels of inclusion, roasted PSM can replace 40% of soybean and 31.19% of maize in broiler starter diets, while 50% of soybean and 24.39% of maize can be replaced in broiler finisher diets [3]. On the other hand, Processing of *Cajanus cajan* seed significantly improved *Cajanus cajan* seed meal (CCSM) utilization and CP retention of the broiler chicks, especially boiled and toasted *Cajanus cajan* seed meal (CCSM) [3].

In our locality pigeon pea promoted to plant on soil and water conserving structures as animal feed. However, at this moment farmers produces pigeon pea seed and they need a means of utilization. On the other hand poultry feed protein source is costly. So, it is important to use this available resource. Therefore the objective of this paper is to study the effect of feeding pigeon pea (*Cajanus cajan*) seed meal on nutrients intake and growth performances of Broiler chicken breeds.

2. Materials and methods

Description of the study area

The experiment was conducted at Sirinka Agricultural Research Center Jari sub Center, located in eastern Amhara region of Ethiopia, about 435 km north east of Addis Ababa. Geographically the experimental site is located at 11°14′N latitude and 39°40′E longitude and at an elevation of 1700 m above sea level (m.a.s.l). The mean maximum and minimum temperature during the growing season was 28.0 and 6.0 C, respectively.

Animals, Experimental Design and Treatments

The experimental period lasted for 7 weeks (starter fed for 3 weeks and finisher fed for 4 weeks). A total of 300 day-old chicks Cobb 500 strain of broiler chicks were initially raised together for one week in a brooding house. At the end of the brooding period (1 week), 285 chicks were randomly assigned to 5 treatment diets in completely randomized design. Each group was replicated 3 times with 19 chicks per replica. The feed conversion ratio (FCR) was determined as total feed consumption divided by change in BW. Birds were sourced from Debire Ziet private poultry farm.

Processing and formulating of feeds

The pigeon pea and soya bean seeds were boiled in an aluminum pot using dried firewood for 30 minute. At the end of the cooking period water was drained off while the seeds were sun-dried until it was dry. After boiling, the seeds were poured out on a clean plastic sheet and allowed to cool. The pigeon pea and soybean seeds were thereafter ground in a grinding mill to the desired particle size using. Five iso-energetic and iso-nitrogenous diets were formulated using boiled pigeon pea meal as the test ingredient to replace soybean meal protein at 0%, 5%, 10%, 15% and 20%.

The diets were compounded manually by weighing the components separately using a sensitive scale at pre-determined percentages (kg/100 kg). The diets were mixed thoroughly to avoid selective feeding by birds on some of the components at the expense of the others. The ingredients used include, maize, soybean meal, boiled pigeon pea meal, premix and salt. The starter diets were fed for 3 weeks, while the finisher diets were fed for the next 4 weeks. The test diets, starter and finisher were, respectively fed *ad libitum* from the 2^{nd} to 4^{th} week and from the 5^{th} to the 8^{th} week in a deep litter house.

Health management

The birds were given vitality soluble powder against stress condition. On the second day, they were vaccinated using Newcastle disease vaccine (1/0). On the 7^{th} and 14^{th} days Newcastle (Lasota) and Gumboro vaccines were administrated. The number of chicks die during the experimental period was insignificant.

Table 1. Chemical composition of feed ingredients used to formulate the experimental rations

Nutrients	Boiled pigeon pea meal	Boiled Soybean meal	Corn grain	Wheat bran
DM %	89	91	91	92
Ash %	3.33	5.55	4.44	14
CP %	21.68	34.06	11.63	18
NDF %	25.55	24.44	17.77	30.13
ADF %	15.55	15.55	8.88	23.64
ADL %	4.44	6.66	3.33	13.04

Table 2. Proportion of ingredients used in formulating diets for the experiment ration (%)

	PSM at 0		PSM at 5%		PSM at 10%		PSM at 15%		PSM at 20%	
	Starter	Finisher	Starter	Finisher	Starter	Finisher	Starter	Finisher	Starter	Finisher
Diet composition										
Maize	56	60	54	57	52	54	44	51	39	52
Soybean	28	21	21	16	14	12	7	8	0	0
Pigeon pea	0	0	8	8	16	15	24	22	32	29
Wheat Bran	15.4	18.4	16.4	18.4	17.4	18.4	24.4	18.4	28.4	18.4
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Min.vit	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100	100	100	100	100	100
Nutrient content										
DM	89	89	89	89	89	90	90	89	89	89
Crud protein	21.3	20.04	21.7	20.43	21.01	20.22	20.98	20.29	21.03	19.53
Ash	21.37	11.23	19.01	10.11	10.11	14.60	11.23	10.11	10.11	10.11
NDF	12.22	20.00	14.44	16.67	14.44	17.78	13.33	21.11	15.56	11.11

PSM at 0=Inclusion of processed pigeon pea at 0, PSM at 5=Inclusion of processed pigeon pea at 5%, PSM at 10=Inclusion of processed pigeon pea at 10%, PSM at 0=Inclusion of processed pigeon pea at 15%, and PSM at 20=Inclusion of processed pigeon pea at 20%.

Data collection

Feed intake

The weights of the feeds served and what were left unconsumed were collected weighed and daily. To obtain the consumption per day feed intake was divided by the number of birds in each replicate to get consumption per day per bird. Body weight and weight gain is the weights of the birds in different replicates were taken weekly and weights gained for the week were obtained by difference. Feed/gain ratio was calculated as the ratio of the feed consumed to the weight gained. Carcass characterization is the last day of the trial, 2 chickens per replicate were randomly selected, weighed, slaughtered, dressed, eviscerated and dissected into thigh, chest, etc. The feed conversion ratio (FCR) was determined as total feed consumption divided by change in BW.

Data analysis

All data collected were subjected to one-way analysis of variance and Duncan's multiple range tests were applied for the separation of the means, where significant differences were noted among the means.

3. Results and discussion

Boiled pigeon pea CP was lower than the CP content of pigeon pea in other studies 27.34% [4]; but under the range of 21-30% [5]. Growth performance and carcass responses data of the broiler chickens are showed in the tables below. Growth performance of experimental of boiler chickens fed Pigeon Pea Seed Meal (PPM) at varying levels of dietary inclusion are presented in Table 4. There were no significant differences ($p<0.05$) in total weight gain at both starter and finisher phases. This result agrees with that of Ani and Okeke [3] that there was no significant ($p<0.05$) difference in weight gain among birds fed diets containing 0 to 20% roasted pigeon pea seed meal.

Table 3. Effect of pigeon pea on birds feed consumption, body weight, and feed conversion ratio

Variables	Treatments					SEM
	PSM at 0	PSM at 5%	PSM at 10%	PSM at 15%	PSM at 20%	
Daily feed consumption (g)	87.73	96.26	96.17	99.47	100.31	1.46
Total feed consumption (g)	4298.8	4717.0	4712.3	4874.3	4915.2	71.9
Initial body weight (g)	160.2	166.3	152.6	156.1	159.9	2.9
Starters final body weight(g)	497.5	457.6	491.6	477.4	470.6	6.9
Starters ABG (g/day)	23.7	21.8	23.4	22.7	22.4	0.32
Starters FCR (g/g)	1.63	1.70	1.67	1.83	1.84	0.36
Final body weight gain(g)	1678.2	1698.9	1738.4	1644.2	1680.6	33.73
Final ABG (g/day)	36.01	35.76	37.51	34.96	36.02	0.60
Final FCR (g/g)	2.56	2.77	2.71	2.96	2.92	0.38

Table 4. Effect of pigeon pea on body weight and body parts

Body parts	Treatments					SEM
	PSM at 0	PSM at 5%	PSM at 10%	PSM at 15%	PSM at 20%	
Dressing weight(g)	1399.9	1418.3	1496.7	1363.7	1427.6	35.9
Eviscerated weight (g)	1195.06	1202.0	1238.6	1187.1	1167.8	23.79
Leg and tight(g)	685.9	694.0	709.0	678.9	653.6	35.9
Chest(g)	197.1	196.3	196.8	203.1	194.9	4.2

Feed intake and Body weight change

Though there was no significant difference in body weight change parameters among treatment groups. Initial (1 week) recorded 166.3g weight were higher than the result of CSA [1] 80.81 g. Final body weight (1738.4) was higher 2141 g than reported by Amaefule et al.,[6].

Results of the present study are in line with the findings of CSA [1], who recorded non-significant differences regarding feed intake and different levels of processed Pp (Pigeon pea) seed meal in broiler diets. The findings of the present study are supported by Ani and Okeke [3], who reported that feed intake, was not affected by dietary inclusion of processed Pp seeds. The results of the present study were disagreed from the findings of Udedibie and Igwe, [5], who found significant differences in feed intake among the groups fed diets containing processed Pp (raw, boiled, and toasted) seeds. Similar results were also found by Adeparusi [8], who reported that the Pp seed coat affected the palatability of Pp meal. The current result within the report of Ani and Okeke [3] evaluated the effect of substitution of PP (cooked) seed meal for corn and soybean meal in the starter diet for broilers, at rates of 0%, 20%, 30%, 40%, and 50%.

Feed Conversion Ratio

Though there was no significant difference in feed intake and FCR parameters among treatment group. FCR (1.84) was in line with other results 1.82 [9]. However, the FCR in starter phase (1.84) is lower than the report of [6] which was 2.86 it may be due to inclusion of Amino acid in the formulation.

4. Conclusions

According to the results of this study pigeon pea seed meal can be used as a substitute for soybean seed meal up to 20% in the broilers diet had no significant effect. However, to be efficient, inclusion of 10% boiled pigeon pea in broilers ration improves the performance of the bird. In addition to efficient feed conversion replacement of soybean by 10% pigeon pea seed meal easily accessible and less costly. There was no any palatability problem and defected observed in all treatment groups. Thus pigeon pea seed can be used as an alternative home grown protein source in broiler feed. Generally, the study showed that pigeon pea seed meal (PSM) could be a good protein source for broilers, which could be incorporated into the diet at 10% of the whole diet.

The result of the study revealed that pigeon seed had a potential for broilers feed, So on farm demonstration should be done in comparisons with commercial broiler ration.

Acknowledgements

The authors are greatly indebted to Ethiopian Institute of Agricultural Research (EIAR) poultry case team for

funding and Amhara Agricultural Research Institute (ARARI) for allowing time and facility for this research
.

References

1. CSA (Central Statistical Agency) Agricultural Sample Survey. Report on Livestock and livestock characteristics (Private peasant holdings). Statistical Bulletin 583.Central Statistical Agency Federal Democratic Republic of Ethiopia, Addis Ababa, 2016, vol. II, pp. 194.
2 Igene, F. U., Isika, M. A., Obon, S. O., Ekundayo, D. A., Maefule, U., Ukpanah, U. A. Ibok, A. E., Replacement value of boiled pigeon pea (*Cajanus Cajan*) on growth performance, carcass and haematological responses of broiler chickens, Asian Journal of Poultry Science, 20126, 1-9.
3. Ani, A. O, Okeke, G. C., The performance of broiler birds fed varying levels of roasted pigeon pea (*Cajanus cajan*) seed meal, Pakistan Journal of Nutrition, 2011; 10, 1036-1040.
4. Amaefule, K. U.,. Obioha, F. C., Performance of pullet chicks fed raw or processed pigeon pea (*Cajanus cajan*) seed meal diets, Livestock Research for Rural Development, 2006, 17, 33. http://www. cipav. org. co/ lrrd/ lrrd 17/ 03 / amae17033.htm
5. Udedibie, A. B. I., Igwe, F. O., Dry matter yield and chemical composition of pigeon pea (*C. cajan*) leaf meal and the nutritive value of pigeon pea leaf meal and grain meal for laying hens, Anim. Feed Sci. Tec., 1989, 24,111-119.
6. Amaefule, K. U., Ukpanah, U. A., Ibok, A. E., Performance of starter broilers fed raw pigeon pea [*Cajanus cajan* (L.) Millsp.] seed meal diets supplemented with lysine and or methionine, International Journal of Poultry Science, 2011, 10, 205-211.
7. Castillo, A. D., Gallo, S. M. H., Peralta, R. C., solis, T., Economic analysis and carcasses quality of broiler chickens, fed with *Cajanus cajan*, Global Advanced Research Journal of Agricultural Science, 20165, 008-013.
8. Adeparusi, E. O., Evaluation of the nutritive potential of cooked pigeon pea (*Cajanus cajan*) meal as a plant protein source for *Clarias gariepinus* fingerlings, Journal of Agricultural technology, 19942, 48-57.
9. Onu, P.N., Okongwu, S. N., Performance Characteristics and Nutrient Utilization of Starter Broilers Fed Raw and Processed Pigeon Pea (*Cajanus cajan*) Seed Meal, International Journal of Poultry Science, 20065, 7, 693-697.