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Research Article

Evaluating Different Levels of Roasted Pigeon Pea (Cajanus Cajan) Meal on Growth Performance of Cockereal Koekoek Chicken Under Adami Tullu Agricultural Research Center, Oromia, Ethiopa

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Abstract

The experiment was conducted to evaluate effects of different level of roasted pigeon pea seed meal inclusion in diet of growing Cockereal Koekoek chicken. The compeletely randomized design was used to evaluate four dietary treatments. The roasted Pigeon Pea meal was included at levels of diet 0% (T1), 25% (T2), 30% (T3) and 35% (T4) in dietary treatments. Each treatment contained 8 chickens, totaling 128 chickens in the whole experiment. The study was conducted for for 84 days. The major factors studied were body weight gain, feed intake and feed conversion ratio (FCR). The results showed that both daily feed intake in T1 and T2 (74.89±12.78 g vs 73.09±13.4 g) and as well as T3 and T4 (71.70±14.2 g vs 69.16±14.43 g) were not statistically significant ($P>0.05$). On the other hand, there was a significantly lower ($P<0.05$) in daily body weight gain of chicken was observed in T4 (19.45±0.53 g) compared to the other treatments. There was no significant differences ($P>0.05$) among T1 (23.94±1.4 g), T2 (21.97±1.16 g) and T3 (21.6±0.6 g) in daily weight gain gram per bird. Significantly ($P<0.05$) lower FCR was observed in T1 (3.03± 0.54) compared to the rest treatments. However, were no significant differences in FCR T2 (3.33±0.61), T3 (3.31±0.67) and T4 (3.56 ±0.74). The selling price of cockerels chickens at end of experiment period chicken in T1 (Birr 271.67±5.77), T2 (Birr 257.67±17.04) and T3 (Birr 238.67±16.17) did not significantly differ ($P>0.05$). Similarly, the selling price of chickens in T3 (Birr 238.67±16.17) and T4 (Birr 217.67±10.78) also did not significantly differ ($P>0.05$). Whereas, there was a significant difference chickens selling price between the T1 (271.67±5.77) and T4 (Birr 217.67±10.78), and T2 (Birr257.67±17.04) T4 (Birr 217.67±10.78). From this study, net incomes of Birr 148.74, 138.25, 102.7 and 74.37 were obtained from T2, T1, T3 and T4, through selling chickens respectively. Generally, from the biological and economical point of view, the inclusion 25% of pigeon pea meal was recommended in diet cockerels' koekoek chicken.

Keywords

Pigeon Pea Meal, Feed Offered, Feed Intake, Feed Conversion, Growth Performance

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The feed shares about 60-70% of total costs in poultry production. The higher cost of poultry feed to total production cost is rising in poultry is generally associated with high cost of important protein sources, such as soybean meal [25]. Poultry are unable to manufacture essential amino acids. Their diet must contain the materials essential for maintenance, production and reproduction. Poultry diet containing high levels of protein are highly essential for maintenance, production and reproduction but expensive to purchase [22]. The high cost and una vailability of commercial protein supplements is one of the main limitations to efficient animal production by small holder farmers [13]. The competition between food and feed is expected to further increase feed prices, forcing producer to look for alternate feeds and locally available protein source feeds for birds.

The pigeon pea grain is used as an alternative protein source in the diet of poultry to reduce farmers` dependence on externally purchased protein concentrate. Pigeon pea (*Cajanuscajan*) seeds are currently considered as a non-conventional feed stuff in poultry feeding and as a valuable protein feed resource [5]. The amino acid profile of pigeon pea is comparable with the conventional plant protein sources [2]. The pigeon pea (*cajanus cajan)* is a good source of soluble vitamins especially thiamin, riboflavin, niacin and choline [21]. Pigeon pea is also good source of dietary minerals such as calcium, phosphorous, magnesium, iron, sulfur and potassium. Even though, it has some anti-nutritional factors, it could be effectively removed by heat processing [11]. Processing pigeon pea seeds also significantly improved its utilization and crude protein retention [3, 11, 24]. These authors found that the nutritional value of processed decorticated and roasted pigeon pea seeds was suitable to be used as chicken diet.

With regard to chemical composition, pigeon pea was found to contain 22-27% crude protein, 7.3-10% crude fiber, 61.2% NFE, 1.7-2.1% EE, 3.1-4.2% ash, and lysine 7.59% [10, 1] However, information was scarce on level of pigeon pea meal utilization for cockerel koekoek chickens feeding.

Therefore, this activity was proposed to address this issue with the following objectives.

1) To evaluate the growth performance of cockerel koekoek chickens fed different levels of pigeon pea seed meal.
2) To know the economic advantage of pigeon pea seed meal using in chicken feed.

2. Materials and Methods

2.1. Description of the Study Area

The experiment was conducted at Adamitulu agricultural research center, located in the mid rift valley of Ethiopia at an altitude of 1650 m.a.s.l. and 7 ٩`N latitude and 38 ٧`E longitude. The average annual rain fall of the area was 700 mm and its mean maximum and minimum temperatures were 27 and 12.5 ℃, respectively [7].

2.2. Feed Management

The feed ingredients used in experimental feed ratio formulation were purchased from local markets. These ingredients were wheat bran, maize, noug seed cake, Limestone, grower premix, and salt. Pigeon pea seed was roasted and then milled before it was used for the formulation of the experimental diets. Accordingly, three experimental diatary treatments were formulated with different level of roasted pigeon pea seed meal inclusion formulated using the above feed ingredients (Table 1). The commercial grower chicken feed to be used as control. It was purchased from the feed processing company.

Table 1. *Feed ingredient composition (%) of the experimental dietary treatment.*

Ingredients	T1 (Commercial)	T2	T3	T4
Pigeon pea		25.00	30.00	35.00
Noug cake		4.00	4.00	4.00
Maize		51.00	51.00	51.00
Wheat bran		12.00	9.00	4.00
Salt		2.00	2.00	2.00
Limestone		4.00	2.00	2.00
Premixes		2.00	2.00	2.00
Total		100	100	100

The experimental dietary treatments were provided daily to each experimental chicken according to their body weight and ages. Left over feeds were collected every next day morning and weighed before providing feed for the day. Water was provided *ad libitum* during experimental period.

2.3. Animal Management

A total of 128 cockerels koekoek chickens of four weeks of age were selected from chickens reared in Adami Tulu Agricultural Research Center poultry farm. The Cockerel koekoek chickens were assigned to the four treatment diets. Eight (8) cockerels were assigned for each treatment diet and each treatment was replicated four times. Deep litter housing system that was partitioned in to 16 equal size pens (4 m^2) was used. The partitioning was made using wood and mesh wire. Before placing the experimental chickens in to the

experimental pens, the whole units were cleaned and disinfected with Dizinon disinfectant and littered with properly dried tef (*Ergrostictef*) straw.

2.4. Data Collection

Feeds offered to the chickens and refusals were measured every morning. The difference between the amount of offered feed and refusals were calculated as intake. The birds were weighed at the beginning of the experiment and subsequently on two weeks basis usually in the morning (8.00 - 9.00 am) hours before providing feed. Weight gain of the birds was calculated as the final live weight minus initial weight. Feed conversion ratio (FCR) was calculated as feed intake divided by weight gain. Mortality records and other observations were kept throughout the period of study.

2.5. Statistical Analysis

Analysis of variance of feed intake and weight gain of cockerel chicken were done using the general linear model (GLM) procedure [20]. When the results were significant, mean comparisons were made using Turkey multiple range test procedure of the SAS package.

Models: Yik = μ + Bi + eik

Where: Yik = individual value of the dependent variables of chicken, μ = Overall mean; Bi = the effect of the level of pigeon pea (I = 1 to 4), eik= random error.

2.6. Economic Analysis

Variable costs collected include prices of dry matter feed intake per bird, vaccine, medicine and disinfectant costs used. Net return was obtained from the estimated price of cockerel chicken based up on local chicken market. The economic benefit was estimated by considering partial budget analysis, according to the formula developed by [8].

$$NI = TR - TVC$$

Where, NI = Net income, TR = Total return, TVC = Total variable cost.

3. Results and Discussions

3.1. Chemical Composition of the Experimental Feeds

The chemical compositions of the formulated experimental diets were analyzed at Adami Tulu Agricultural Research Center Animal Nutrition laboratory using the method [6] proximate principles. The nutritional composition of the control (commercial) feed was taken from the feed processing company. Nutritional composition of the feed treatment is given in Table 2.

Table 2. *Nutritional composition (%) of experimental diets.*

TR	DM	Ash	OM	CF	CP	NDF	ADF	ME (kcal/kg DM
1	94.75	5.6	89.15	5.0	18.00	22.56	11.49	2950
2	94.77	5.5	89.27	6.5	18.50	23.08	11.46	2946
3	93.97	3.9	90.07	10.5	19.00	23.62	10.65	2943
4	94.72	7.4	87.32	11.0	19.50	25.87	10.61	2942

3.2. Feed Intake and Live Weight Change of the Birds

The mean daily feed intake, total feed intake, daily weight gain, total weight gain, final body weight gain, feed conversion ration and price of the cockerel koekoek chickens are summarized in Table 3. The daily feed intake in gram per chicken, hence the total feed intake in gram per chicken were not statistically different (P>0.05) between T1 and T2, between T3 and T4. With this circumstance, both daily and total feed intake in T1 is from T3 and T4, as well as T2 is also tween significant difference (P<0.05) from T3 and T4. The difference might be due to increased crude fiber content of experimental diets. The lower feed intakes were observed in T3 and T4 where relatively higher level of pigeon pea meal was include. This was indicated that as amount of roasted pigeon pea seed meal used increased the crude fiber content and protein content of the feeds increased and resulted in decreased feed intake and weight gain. The energy content of the experimental diets is main determinant of feed intake [16, 14].

Increasing crude fiber affected the palatability of the diet and hence the feed intake. This is in agreement with [18] who reports higher crude fiber reduce intake of broiler chicken. The current finding also agree with [16] who found lower diet

intake by vanda chickens because of the higher crude fiber content of the experimental diet used. The high fiber poultry diets decreased feed intake and body weight gain was reported by [17]. The current finding is again also in agreement with the findings of [12] who reported lower weight gain for birds fed higher dietary fiber feed of lower energy content. However, the current finding disagrees with the report of who reported [19] who was reported higher feed intake from using high level of crude fiber compared to using low level of crude fiber. This could probably be due to difference in the breed type used.

The current finding indicated the 25% roasted pigeon pea seed meal inclusion in whole cockerel diet did not adversely affect feed intake and body weight gain of cockerel koekoek chickens. Different authors reported different level of pigeon pea seed meal inclusion in diet of chickens. Lower feed intake and lower weight gain from using 40% cooked pigeon pea seed meal for cockerel chicken reported by [9]. On the otherhand, [4, 15] concluded and recommended that inclusion of 20% pigeon pea meal into the whole grower diet had no any adverse effect on growth performance of grower cockerels. Whereas, processed pigeon pea seed meal can be included in cockerel diets up to 30% with out affecting the meat component of cockerels [24].

Significantly ($P<0.05$) lower FCR was observed for T1 compared to the other three treatments. This indicates the good quality of the diet as feed conversion ratio is the amount of feed required for a unit of weight gain. This is because of the lower crude fiber content, good palatability and essential amino acid content of the commercial diet, since feed processing companies prepare commercial diet with balanced amino acid for poultry.

Table 3. *Feed intake and live weight change of the cockerel kokekoek chicken fed the experimental diets (mean ± s. deviation).*

Parameters	T1	T2	T3	T4
Initial body weight (kg/bird)	0.35 ±0.03	0.32 ±0.16	0.33 ±0.02	0.33 ±0.03
Mean daily feed intake (g/bird)	74.89 ±12.78^{a}	73.09 ±13.47^{a}	71.7 ±14.2^{b}	69.16 ±14.43^{b}
Mean total feed intake (g/bird)	6291 ±12.78^{a}	6139.56 ±13.47^{a}	6022.8 ±14.2^{b}	5848.92 ±12.8^{b}
Mean daily weight gain (g/bird)	23.94 ±1.4^{a}	21.97 ±1.16^{a}	21.6 ±0.6a	19.45 ±0.53^{b}
Mean total weight gain (g/bird)	2350 ±12.14^{a}	2150 ±16.11^{a}	2110 ±10.06^{a}	1910 ±14.05^{b}
Final body weight (Kg/bird)	2.70 ±0.11^{a}	2.48 ±0.11^{b}	2.45 ±0.40^{b}	2.24 ±0.02^{c}
FCR (feed: gain)	3.03 ± 0.54^{b}	3.33 ±0.61^{a}	3.31 ±0.67^{a}	3.56 ±0.74^{a}

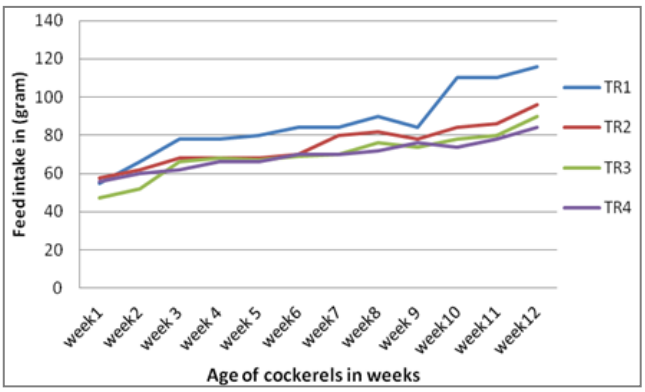

Figure 1. *Average weekly feed intake of the experimental chicken during the study period.*

The Changes in average weekly feed intake and average weight gain of the cockerel koekoek chicken during the study period are indicated Figures 1 and 2 respectively. As age of the chicken advanced their feed intake increased (Figure 1). The reason might that in fact that the development of different organs, muscles and feathers need high amount of quality feed.

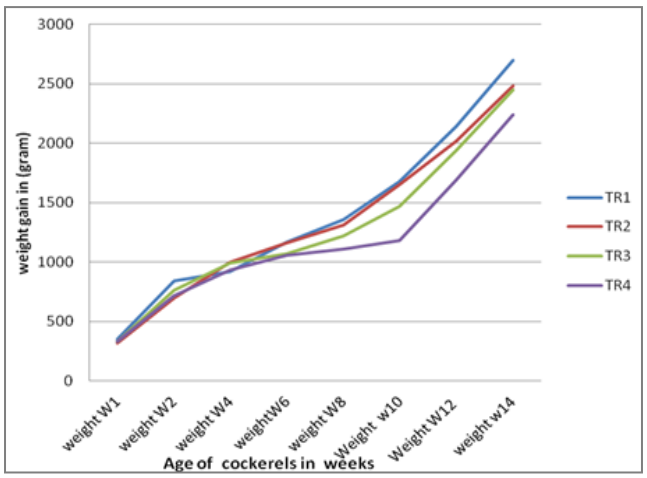

Figure 2. *Average weekly body weight gain of experimental chicken during the study period.*

The weekly weight gain of cockerel koekoek chickens (Figure 2) followed the same trend as the weekly feed intake. Especially after 9th week of age, the higher weight gain observed was directly related with the higher feed intake of the birds over the same period. The final weight that the experimental chicken attained in the current study, especially those in T1 and T2 are similar report of [23] who reported for same chickens breed at five months of age.

3.3. Partial Budget Analysis

The selling prices of experimental chickens in T1, T2 and T3 were not statistically different (P>0.05). Similarly, there were also no signifant different (P>0.05) selling price of experimental chicken between T3 and T4. But there was a significant (P<0.05) difference the selling price experimental chicken between T1 and T4 and as well as between T2 and T4. This might be due to the different of body weight as in Ethiopa context the prices of chicken usually highly dependent of estimated body weight. In this study the net income of Birr 148.74, 138.25, 102.7 and 74.37 was obtained from chickens in T2, T1, T3 and T4 respectively.

Table 4. *Partial budget analyses.*

Partial budget cost	T1	T 2	T3	T 4
Feed consumed (kg/Chicken)	6.291	6.139	6.022	5.85
Day old chicken purchase (ETB)	10.00	10.00	10.00	10.00
Feed purchase (ETB)	74.42	49.93	76.97	84.3
Medification and Sanitation (ETB)	24.00	24.00	24.00	24.00
Pen construction (ETB)	25.00	25.00	25.00	25.00
Total variable cost (TVC) (ETB)	133.42	108.93	135.97	143.3
Cockerel Selling Price (GR)(ETB	271.67 ± 5.77^{a}	257.67 ± 17.04^{ab}	238.67 ± 16.17^{abc}	217.67 ± 10.78^{c}
NR (GR-TVC)	138.25	148.74	102.70	74.37

4. Conclusions and Recommendations

This study revealed that inclusion of roasted pigeon pea seed meal up to 25% in diet in whole cockerels koekoek chicken ration used as a protein source in poultry ration enable to formulation of a good poultry ration with a reasonable cost. Thus, it improved growth performance of chicken and relatively better body weight gain. Inclusion roasted pigeon pea seed meal more the results current study resulted in lower feed intake and body weight gain. In hot environmental areas where feed intake affected by heat stress and where more concentrated feed needed for poultry, inclusion of higher percentage (greater than 25%) of roasted pigeon pea in cockerels ration negatively affected feed intake and weight gain of chickens. From the biological and economical data obtained, the 25% roasted pigeon pea meal inclusion in cockerels' koekoek chicken as protein source is recommended in cockerel koekoek chicken diet. Therefore, pigeon pea seed meal was reccomened for smallholders' farmers those who cannot affordably purchase commercial poultry feed. Pigeon pea production, popularization and training and creating awareness should be given for farmers on the value poultry rearing.

Abbreviations

FCR	Feed Conversion Rate
GR	Gross Return
ETB	Ethiopian Birr

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Ahmed, B. H, Abdel, K. A, Ati and ElawadS. W. 2006. Effect of feeding different level of soaked pigeon pea (*Cajanuscajan*) seeds on broiler chickens performance and profitability. J. of animal veterinary science, (1): 1-4.

[2] Akande, k. E, Abubakar M M, Adegbola T A, Bogoro S. E and Doma U D. 2010. Chemical Evaluation of the Nutritive Quality of Pigeon Pea *Cajanuscajan* (L.) Millsp.]. International Journal of Poultry Science 9(1): 63-65, 2010.

[3] Amaefule, K. U and obioha F. 2005. Performance of pullet chicks fed raw or processed pigeon pea (*Cajanuscajan*) seed meal diets. Livestock Research for Rural Development 17(3) 2005.

[4] Amaefule, K. U, Ironkwe M. C. and Ojewola G. S. 2006. Pigeon Pea (Cajanuscajan) Seed Meal as Protein Source for Pullets: Performance of Grower Pullets Fed Raw or Processed Pigeon Pea Seed Meal Diets. International Journal of Poultry Science 5(1): 60-64, 2006.

[5] Amaefule, K. U and Onwudike O C. 2000. Comparative evaluation of the processing methods of pigeon pea seeds (*Cajanuscajan*) as protein source for broilers. Journal of Sustainable Agriculture and the Environment. 1: 134-136.

[6] AOAC (Association of official Analytical chemist) (1990). 15th ed. AOAC Arlington, vergina, USA. CIMMT (International Maize and Wheat Improvement Center). (1988). From Agronomic Data to Farmer Recommendations: An economics training manual. CIMMT, DF, Mexico.

[7] ATARC (Adami Tulu Agricultural Research Center). (2020). Adami Tulu Agricultural Research center Metrological data Report.

[8] CIMMT (International Maize and Wheat Improvement Center). (1988). From Agronomic Data to Farmer Recommendations: An economics training manual. CIMMT, DF, Mexico.

[9] Etuk, E. B and Ubedibie, A. B. I. 2003. Effect of cooked pigeon pea (Cajanuscajan) seed meal on the performance of Broiler chickens. JASR. Vol. 3, No. 1, 2003.

[10] Girmand, P. 1988. The pigeon pea A possible Alternative for traditional pig and Poultry farming in New Caledonia, Medicine veterinary d-e Nouvelle Caledonia, 11: 29-36.

[11] Khadiga Abbas Abdelati1, Hashim Abdel Rahman Mohammed1 and Mohamed Elamin Ahmed. 2009. Influence of Feeding Processed Pigeon Pea (*Cajanuscajan*) Seeds on Broiler Chick Performance. International Journal of Poultry Science 8(10): 971-975, 2009.

[12] Krás, R V. Kessler A M. Ribeiro, A M L. Henn, JDi. Santos II dos. Halfen DP. Bockor L. 2013. Effect of dietary fiber and genetic strain on the performance and energy balance of broiler chickens. Brazilian Journal of Poultry Science [online]. 2013, v. 15, n. 1 [Accessed 26 August 2021], pp. 15-19. Available from: Epub 12 Apr 2013. ISSN 1806-9061. https://doi.org/10.1590/S1516-635X2013000100003

[13] Martens Siriwan D, TiemannTassilo T, BindelleJérôme Peters Michael, Lascano Carlos E. 2012. Alternative plant protein sources for pigs and chickens in the tropics – nutritional value andconstraints: a review. Journal of Agriculture and Rural Development in the Tropics and Subtropics Vol. 113 No. 2(2012) 101-123.

[14] MelesseA. 2007. poultry production and management in the tropics: Teaching material Hawassa university College of Agriculture. Hawassa Ethiopia, P, 30, 195, 206, 241, 242.

[15] Mukhtar A, Mukhtar Atif E and Amal O. 2013. Rsponse of broiler chicks fed on diets containing graded levels of pigeon pea (*cajanuscajan*) seeds supplemented with essential caraway oil. Journal of current research in science (ISSN 2322-5009) 2013, Vol. 1, No. 2, pp: 109- 112. Available at www.jcrs010.com

[16] Muzi M, Ginindza, Jones Ng`ambi, David Norris. 2017. Effect of dietary crude fiber level on intake, digestibility and productivity of slow-growing indigenous Venda chickens aged one to 91 days. February 2017 Indian Journal of Animal Research 51(OF) https://doi.org/10.18805/ijar.v0iOF.7255

[17] Rajesh Jha and Pravin Mishra. 2021. Dietary fiber in poultry nutrition and their effects on nutrient utilization, performance, gut health, and on the environment: a review. Journal of Animal Science and Biotechnology volume 12, Article number: 51(2021).

[18] Saeed, M. S., Khadiga A. Abdel Ati. 2007. Inclusion of Pigeon Pea (*Cajanuscajan)* Seed on Broiler Chick's Diet. Research Journal of Animal and Veterinary Sciences, 2: 1-4, 2007, INSI net Publication.

[19] Salami, R. I. and Odunsi, A. A. 2017. Effect of varying dietary fiber and energy levels in multi-fibre source-based diets on growth performance of broiler finisher chickens. *Nigerian J. Anim. Sci. 2017(2): 72-82.*

[20] SAS. (2001). SAS user`s Guide: statistics, Release 8.2. SAS Inst., carry. Nc.

[21] Singh, S. K. 1977. Food legumes: distribution, adaptability and biology of yield P. 1-102. In: FAO plant production and protection paper 3. FAO, Rome WPAS (World poultry Association). 2013. Feed resources and chicken production in Ethiopia. *Journal of World poultry Association, 2013.*

[22] Smith JA (2001). The tropical Agriculturalist. Poultry. *Macmillan Education Ltd 1990, 2001.*

[23] Tesfa Geleta and Usman Abdulkadir. 2018. Production performance evaluation of Koekoek chickens at Adami Tulu research center. African Journal of Agricultural Research. *Vol. 13(35), pp. 1852- 1856, 30 August, 2018.*

[24] Yisa, A. G. Edache, J. A. Oyawoye, E. O. Diarra, S. S. Yakubu, B. 2010. The effect of graded levels of boiled and dried pigeon pea seed meal on the carcass of cockerels. *Journal of Environmental Issues and Agriculture in Developing Countries, Volume 2 Numbers 2 & 3, 2010.*

[25] Zakaria HA and Shammout MW. 2018. Duckweed in Irrigation Water as a Replacement of Soybean Meal in the Laying Hens' Diet. Brazilian Journal of Poultry Science, ISSN 1516-635X / v. 20 / n. 3 / 573-582.