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Original Article

Growth Performance of Broilers Fed Diets with Different Levels of Jackfruit (*Artocarpus heterophyllus* Lam.) Seed Meal

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ABSTRACT

A study was conducted to assess the effect of Jackfruit (*Artocarpus heterophyllus* Lam.) seed meal (JSM) on growth performance of broiler. The effect of treatments were investigated in a 240 Cobb broilers grouped into four dietary treatments (control, 5% JSM, 10% JSM, and 15% JSM diets) at 10 birds per 6 replicates following Completely Randomized Design (CRD). The type of starter ration treatment was found to have a significant effect on the total weight gained by the broilers. The same trend is also seen in the average daily gain wherein the type of starter ration significantly affected the parameter at $p<.05$ level. At $p<.05$ level, the finisher ration treatment was found to significantly affect both the total weight gained (g) ($p=0.027$) and average daily gain (g) ($p=0.003$). On the other hand, jackfruit seed meal incorporated in the feed ration was found to have a significant effect on the total feed consumed (g) as well as feed conversion ratio on the growing and finishing stages. However, for the FCR, the control and 15% JSM had comparable means, which were lower than 5% and 10% JSM. It is concluded that Jackfruit seeds along with other co-products can be used as an alternative feed. The significantly lower values in FCR and other productive parameters obtained by the birds fed diets with jackfruit seed meal could be attributed to two factors, the presence of anti-nutritional factors and conspicuous low dry matter composition of the seed meal used in starter and finisher treatment diets.

KEYWORDS: *average daily gain, feed conversion ratio, Jackfruit, ration*

1 INTRODUCTION

In the Philippines and other developing countries, a major constraint to livestock production is the scarcity and fluctuating quantity and quality of the year-round feed supply. Serious shortages in animal feeds of the conventional type are experienced because food grains are mostly required almost exclusively for human consumption (Makkar, 2002). As cited by Devendra *et al.* (2000), nonconventional feed resources (NCFRs) or nontraditional feedstuffs along with agro-industrial byproducts help in alleviating feed deficits by serving as substitute to the four (4) traditional feed ingredients since they are not utilized for human consumption and for commercial animal diets. NCFRs include a range of valuable feeds such as the skins, pulps, and seeds of fruits (i.e. from the canning industry). Jackfruit (*Artocarpus heterophyllus* Lam.), as reported by the Agriculture and Fisheries Information Service of the Department of Agriculture (DA), is one of the most widely grown fruit crops in the Philippines because it produces large edible fruit, which can weigh as much as 50 kg. The use of jackfruit seeds as an NCFR is especially gaining momentum, given its ability to address the afore-mentioned constraints. According to Ravindran (2010), jackfruit is available in economic quantities, its price is competitive against the main feedstuff, and its nutritive value has been studied extensively. It is however, necessary to study its efficacy as an NCFR for broiler chicken production. Thus, this study was undertaken to investigate the production performance of broilers.

2 MATERIALS AND METHODS

Preparation of the Jackfruit Seed Meal

The jackfruit seed meal was prepared at the Department of Food Science and Technology (DFST), Visayas State University, Visca, Baybay City, Leyte. Fresh, whole, ripe jackfruits of the AES Jak #1 and AES Jak #2 cultivar weighing around 5.2 kg, medium, and ovoid in shape with rich yellow flesh were obtained. The drying period of jackfruit seeds was observed to facilitate proper milling. This milled jackfruit seed is what is called the jackfruit seed meal. This was stored until use during the formulation of the starter and finisher treatment diets or rations.

The Treatment Diets and Experimental Design

The four (4) treatment diets of the starter and finisher rations were formulated as follows: T0: Starter/Finisher ration, without jackfruit seed meal (Control); T1: Starter/Finisher ration with 5% of jackfruit seed meal; T2: Starter/Finisher ration with 10% of jackfruit seed meal and T3: Starter/Finisher

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ration with 15% of jackfruit seed meal. This study used a Completely Randomized Design (CRD). Two hundred forty broilers were selected from the 250 day-old chicks that were raised up to 14 days were individually selected and randomly distributed into four (4) treatment diets with six (6) replicates per treatment having 10 birds per replicate. Birds in each replicate were reared together in the same cage from day 15 up to completion of the experiment.

Formulation of the starter and finisher rations and their proximate analysis

The starter and finisher rations were formulated using the jackfruit seed meal and other feedstuffs available at the PRCRTC Feedmill and local agri-vet stores in Baybay City, Leyte. Each of the two rations was fed to the broilers for 14 days. Specifically, the starter ration was given during days 15-28 of the feeding trial and the finisher, days 29-35. For each of the starter and finisher rations, four (4) different diets were formulated using the Trial and Error Method already described (Jerry, 2004; Talat, 2004 as cited by Afolayan and Afolayan, 2008).

After formulation of the four (4) treatment diets of both starter and finisher rations, a representative sample was obtained for determination of their individual proximate composition following the method of the Association of Official Analytical Chemists (AOAC) (AOAC, 1990 as cited by Wagner and Stanton, 2011) as described in Table 1.

The experimental birds and their management

A three-phase feeding was observed in the feeding of the birds in this study including brooding, growing and finishing. During the brooding period, the feeding and watering was uniform for all the 250 birds. The starter treatment diets were given during the 15th - 28th day of the experiment while the finisher treatment diets, 29th –35th day of the experiment. To avoid problems related to sudden change in the diet, gradual shifting was practiced such that on the 7th day, the full amount of the new diet was given. To determine total and average feed consumption of each treatment diet, the total amount of feed given as well as the refused which was collected early in the morning the following day before feeding, was recorded. For the former however, the recording was done starting on Day 1 up to the end of the experiment.

Analysis of Data

All production performance data were subjected to One-Way Analysis of Variance (ANOVA). The Honestly Significant Difference (HSD) test was used to compare differences among treatment means.

3 RESULTS AND DISCUSSION

Effects of inclusion of Jackfruit seed meal on broiler performance on total weight gained and average daily gain

Results showed that the type of starter ration treatment was found to have a significant effect ($p=0.000$) on the total weight gained by the broilers. The same trend is also seen in the average daily gain wherein the type of starter ration significantly affected ($p=0.000$) the parameter at $p<.05$ level. On the other hand, at $p<.05$ level, the finisher ration treatment was found to significantly affect both the total weight gained ($TWtG_{Fin}$) (g) ($p=0.027$) and average daily gain (ADG_{Fin}) (g) ($p=0.003$).

These results only confirm the report of Ravindran (2010) in which it was stated that jackfruit seeds along with other fruit co-products can be used as an alternative feed in poultry rations particularly in home-mixed rations in which the objective is economic productivity rather than maximum biological productivity. According to the above author, jackfruit seed meal can be included up to 30% of poultry rations. However, Ravindran (2010) suggests the need to resolve the problem of using raw or unprocessed jackfruit seeds in view of the lectins contained therein. Literature contradictory to Ravindran's (2010) report above is scanty. Ironically however, the same author showed in one of his studies that inclusion of jackfruit seed meal in broiler rations depressed growth rate and even contributed to chick mortality. As explained, this is because of the presence of anti-nutritional factors including lectins in raw jackfruit seeds. This is probably the reason why in this study, increasing the proportion of jackfruit seed meal, which was cooked (instead of raw), in the ration resulted in increased growth although the rate was significantly lower than that of birds that did not have jackfruit seed meal in their ration.

The effect of anti-nutritional factors on animal productivity is thoroughly explained by Wu and Inglett (1974), Douglas *et al.* (1992) and Elkin *et al.* (1995). According to these authors, nutritional factors limit the utilization of seeds containing them and particularly in broilers, they reduce growth rate due to reduced protein and specific amino acid utilization.

On feed consumption and feed conversion ratio

The percentage of jackfruit seed meal incorporated in the feed ration was found to have a significant effect on the total feed consumed (g) as well as feed conversion ratio on the growing and finishing stages. For the total feed consumed, the control had a lower mean compared to other treatments. However, for the FCR, the control and 15% JSM had comparable means, which were lower than 5% and 10% JSM.

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According to Ferket and Gernat, 2006, Feed Conversion Ratio (FCR) is the ultimate of all the productivity parameters used to assess broiler performance. It relates to the amount of feed consumed by the birds and the resulting weight gain of the broilers. It is affected by both biological and environmental factors and among the latter factors, feed quality and quantity have the biggest impact on this parameter. Ferket and Gernat (2006) add that in order for producers to attain the best FCR, the energy and protein intake should be of prime consideration. The Ministry of Agriculture, Food and Rural Affairs (of Ontario, Canada) (2001) however holds a different opinion. It claims that a broiler bird eats to its maximum physical capacity and that its energy intake can easily be controlled by varying the energy density of the diet. However, this is true only young broiler birds, because its early growth rate can be tempered by feeding lower energy diets. However as the broiler gets older it does seem to adjust its intake in relation to diet energy level. As the nutrient level of the diet is reduced, so birds eat more feed. This means that the bird may not eat to physical capacity, because it is able to almost double its normal intake on low nutrient dense diet. However, if energy efficiency is calculated, then the birds on the lowest energy feed are actually the most efficient in converting feed energy to weight gain. This is a good example of classical measures of feed efficiency being totally misleading. It is unlikely that the low energy levels would be economical, because it is difficult to find low energy ingredients that are inexpensive per unit of energy. However evidence accumulated on this matter show a range of energy levels for the broiler can be considered, without affecting growth rate too much thus diet choice is in fact a matter of allowing formulation programs to select the most optimum solution.

In this study, the significantly lower values in FCR and other productive parameters obtained by the birds fed diets with jackfruit seed meal could be attributed to two factors, the presence of antinutritional factors and the conspicuous low dry matter composition of the seed meal used in the starter and finisher treatment diets.

Table 1. Proximate composition of jackfruit seed meal and other feedstuffs used in the rations

	Dry matter (%)	**Moisture (%)**	**Crude protein (%)**	**Ether extract (fat) (%)**	**Fiber (%)**	**Ash (%)**
Jackfruit seed meal	39.72	60.28	14.34	0.41	2.03	1.10
Rice bran	89.00	11.00	12.50	13.00	6.00	7.50
Copra meal	94.00	6.00	20.00	9.00	11.0	6.50
Fish meal	85.73	12.47	50.00	14.70	1.06	21.65
Soybean meal	90.00	10.0	43.00	1.00	3.50	7.00
Vegetable oil	98.00	2.00		98.00		
Vitamin-mineral Premix*	-	-	-	-	-	-

*As supplied by manufacturer

Table 2. Total weight gained ($TWtG_{Fin}$) (g) and average daily gain (ADG_{Fin}) (g) of broilers fed starter rations with different levels of jackfruit seed meal (JSM)

Treatments	**Total Weight Gained (g)**	**Average Daily Gain (g)**
T_0=0% jackfruit seed meal	440.00^{a}	62.86^{a}
T_1=5% jackfruit seed meal	380.17^{b}	58.54^{b}
T_2=10% jackfruit seed meal	379.92^{b}	59.01^{b}
T_3=15% jackfruit seed meal	440.17^{a}	63.18^{a}
CV (%)	9.68	3.92

Means in a column within a factor followed by the same letters are not significantly different from each other based on the 5 percent level of significance in ANOVA and Tukey's HSD.

Table 3. Total weight gained ($TWtG_{Fin}$) (g) and average daily gain (ADG_{Fin}) (g) of broilers fed finisher rations with different levels of jackfruit seed meal (JSM)

Treatments	**Total Weight Gained (g)**	**Average Daily Gain (g)**
T_0=0% jackfruit seed meal	635.83^{a}	108.27^{a}
T_1=5% jackfruit seed meal	439.33^{b}	92.56^{b}
T_2=10% jackfruit seed meal	539.17^{ab}	100.45^{ab}
T_3=15% jackfruit seed meal	609.17^{ab}	105.95^{b}
CV (%)	23.24	8.58

Means in a column within a factor followed by the same letters are not significantly different from each other based on the 5 percent level of significance in ANOVA and Tukey's HSD.

Table 4. Total feed consumed (g) and feed conversion ratio (FCR) during the growing stage of broilers fed with various percentages of jackfruit seed meal

Treatments	**Total Feed Consumed (g)**	**Feed Conversion Ratio**
T_0=0% jackfruit seed meal	868.00^{b}	1.98^{b}
T_1=5% jackfruit seed meal	932.83^{a}	2.45^{a}
T_2=10% jackfruit seed meal	943.67^{a}	2.48^{a}
T_3=15% jackfruit seed meal	941.00^{a}	2.17^{b}
CV (%)	4.03	11.27

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Means in a column within a factor followed by the same letters are not significantly different from each other based on the 5 percent level of significance in ANOVA and Tukey's HSD.

Table 5. Total feed consumed (g) and feed conversion ratio (FCR) during the finishing stage of broilers fed with various percentages of jackfruit seed meal

Treatments	Total Feed Consumed (g)	Feed Conversion Ratio
T_0=0% jackfruit seed meal	1515.00[b]	2.38[b]
T_1=5% jackfruit seed meal	1613.33[a]	3.52[a]
T_2=10% jackfruit seed meal	1634.00[a]	3.04[a]
T_3=15% jackfruit seed meal	1620.17[a]	2.67[b]
CV (%)	3.59	18.49

Means in a column within a factor followed by the same letters are not significantly different from each other based on the 5 percent level of significance in ANOVA and Tukey's HSD.

4 CONCLUSION

This study revealed that the varying proportion of jackfruit seed meal in the starter and finisher rations affected the performance of the broilers. Weight gain (g) during the growing period when the birds were fed the starter treatment diets, T3 (15% JSM) gave comparable results to T0 (0% JSM) and both T0 and T3 mean total weight gained were significantly different from that of T1 (5% JSM) or T2 (10% JSM). However in terms of weight gain during the finishing period when the birds were fed finisher treatment rations, the treatments that significantly differed in total weight gained were T0 (0% JSM) and T1(5% JSM). In terms of the average daily gain (g) of the birds during the growing period, significant differences existed between T_3 and T_0 to that of T_1 and T_2 while during the finishing stage, T_0 and T_3 significantly differed from that of T_1. The effect of inclusion of JSM in the ration on total feed consumed and feed conversion ratio (FCR) was the same as for the abovementioned parameters in that in terms of the former, T_0 had a lower mean compared to the other treatments however, in terms of the latter, T_0 and T_3 were comparable but were lower than T_1 and T_2.It is concluded that Jackfruit seed meal could be included in the ration of broilers however, there is a need to develop a more effective method of treatment of the jackfruit seeds before incorporation into either the starter or finisher ration to resolve the issue on the effect of the presence of anti-nutritional factors in the jackfruit seed meal that affect the utilization of the nutrients of the whole ration by the birds. Finally, there is also a need to evaluate the effect on the parameters considered in birds from day 1 to day 14 since in this study, the treatment rations were utilized starting on Day 15.

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