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Growth Performance of Finisher Broilers Fed with Ration Containing Potato *(Solanum tuberosum)* Meal as Partial Substitute to Corn

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ABSTRACT

The study was conducted to determine the feed intake, growth rate and efficiency of feed utilization of broilers fed with finisher ration formulated with different levels of potato meal as partial substitute to corn. This was conducted at the Benguet State University Poultry Experimental Farm from September to October 2013. Following the Completely Randomized Design (CRD), 120 heads of 30-day old birds were distributed using three treatments as follows: 0% potato meal (T_0); 10% potato meal (T_1); and 20% potato meal (T_2). The average initial weight of birds taken at 30 days of age was 1.29 kg. The average daily feed intake across the treatments was 0.15 grams. Differences were observed in average daily weight gain and feed conversion ratio. Birds given ration containing 0% and 10% potato meal had higher average daily gains in weight of 0.05 and 0.06 kg, respectively, compared to birds given ration containing 20% potato meal with an average daily weight gain of 0.04 kg. Birds given ration containing 0% and 10% potato meal had better feed conversion ratios of 2.93 and 2.66, respectively, compared to birds given ration containing 20% potato meal with average feed conversion ratio of 3.35 kg. Results of the study showed that 10% rations containing potato meal can be included in the finishing rations for broilers.

Keywords: *Potato meal, broiler, finishing ration, growth performance*

INTRODUCTION

Grains are known to constitute 60-70% of broiler feeds (Ekenyem, 2007). One of the major problems facing the broiler industry today, however, is the high cost of feeds resulting from shortage of high energy grains (Mmereole 1996; Mmereole, 2008). The high cost of grains is due largely to competition between livestock and man. For this reason, some low-income and food-deficit countries (LIFDC) have closed their broiler farms due to the high cost of broiler feeds (Ekenyem, 2007).

The traditional broiler diet is formulated with a large proportion of grains. Maize has traditionally been the ingredient of choice for the supply of energy in monogastric animal diets with inclusion levels of 50-70% (PAN, 1995). It accounts for 18% of the world cereal acreage and about 25% of the world cereal production (Haque, 1996). Local production of wheat and maize especially from years 2003 to 2004 has not been able to meet the demands of man, poultry and livestock. As a result, grain importation had increased each year using hard earned foreign currency. Moreover, use of costly imported grains in the diet increases feed cost, high enough to limit broiler rearing. Nutritionists are thus suggesting the use of cheaper unconventional locally available substitutes to grains like cassava tuber meal (CTM), and potato meal (PM) for better profitability (Rahman and Reza 1983; Hossain *et al.*, 1989).

The high cost of food-energy sources like maize and wheat for broiler diet has been the main cause of expensive broiler products especially in developing countries. To address this situation, broiler raisers have been looking for plants that can easily be grown and with yield per land area comparable to corn, for inclusion in broiler rations.

Potato (*Solanum tuberosum*) is a local crop feed ingredient for broilers grown in abundance

in Benguet. It has a high production potential with fresh tuber yield of 20 tons/ha, whereas maize and wheat yields are about 5 tons/ha and 7 tons/ha, respectively. Potato is an energy source that could substitute for maize or other cereals for feeding broilers. Potato Meal (PM) has an energy value of more than 2,830 Kcal ME/kg. According to composition values, PM contains more than 65% starch, 6.74% ash, 12.72% Crude Protein (CP), 23.48% Crude Fiber (CF), and 0.99% Ether Extract (EE) on Dry Matter (DM) basis. Potato meal has been reported to be cheaper than maize and wheat (PAN, 1995). Moreover, huge amounts of potatoes are being wasted due to lack of cold storage facilities in the country. The volume of non-marketable potato tubers from Benguet Province accounts for 23.80% of the total potato production (Salda, 2016). Considering the above points, potato may have the potential of replacing maize in broiler rations.

The study was conducted at the Benguet State University Poultry Experimental House, Barangay Balili, La Trinidad, Benguet from August 2013 to October 2013.

Objectives of the Study

Generally, the study aimed to determine the growth performance of broilers fed with ration containing potato meal during the finishing period. Specifically, it aimed to determine the growth rate and efficiency of feed utilization of broilers fed with rations containing 10% and 20% potato meal during this period.

METHODOLOGY

Experimental design and treatment. Using the Completely Randomized Design (CRD), 31-day old birds were distributed at random into 3 treatments, replicated four times with 10 birds per replicate. The dietary treatments were as follows:

Treatment 0 – 0% potato meal
Treatment 1 – 10% potato meal
Treatment 2 – 20% potato meal

The experimental ration was given *ad libitum* to broilers from day 31 to day 45. Potable water was provided *ad libitum* to all birds throughout the experimental period.

Preparation of potato meal. Potato tubers were washed, drained, and sliced into 3-5 mm thick chips. The chopped potatoes were oven-dried until brittle. The oven-dried potatoes were then crushed into a meal before mixing in predetermined amounts of experimental rations (Table 1).

Experimental ration. Rations were formulated to contain the same crude protein content. The experimental diets were formulated to contain 0%, 10%, and 20% potato meal. The PM experimental ration was sent to the Animal Nutrition Division, University of the Philippines, Los Baños Laguna for proximate and energy analysis while the crude protein contents of the ground yellow corn, soybean meal, fish meal, and rice bran D1 were based on book values (Gerpacio *et. al.*, 1978). Potato meal proximate and energy analyses showed that potato meal contains 8.64% crude protein (Table 1). Moreover,

Table 1. Composition of the experimental finisher ration

		PARTS BY WEIGHT		
INGREDIENTS	CP %	0% potato meal	10% potato meal	20% potato meal
Potato Meal	8.64	0.00	10.00	20.00
Ground Yellow Corn	8.50	59.97	49.92	39.96
Soybean Meal	47.00	19.54	19.83	19.79
Fish Meal	60.00	5.24	5.00	5.00
Rice Bran, D_1	12.50	15.00	15.00	15.00
Vitamin and Mineral Premix	0.00	0.25	0.25	0.25
Total		100.00	100.00	100.00
Computed CP		19.30	19.30	19.30

Table 2. Nutrient content of PM ration determined by analysis

Nutrients	0% potato meal	10% potato meal	20% potato meal
Crude protein (%)	19.11	19.13	19.38
Crude fiber (%)	2.30	3.20	3.00
Crude fat (%)	2.73	4.63	3.67
Ash (%)	4.06	3.80	5.32
Moisture (%)	10.69	10.95	9.73
Nitrogen free extract (%)	61.11	58.29	58.90
Gross energy (Kcal/kg)	4,126	4,177	3,939

analysis also showed that the PM ration had 4.77% moisture, 4.45% ash, 2.83% crude fiber, 0.60% crude fat, 78.71% nitrogen free extract and 3.998% gross energy kcal/kg.

The experimental rations were formulated to contain the same percent of crude protein content of 19.30 (Table 1). However, analysis showed variation in actual crude protein content of the ration. The percent crude protein content of the experimental ration containing 0, 10% and 20% potato meal were 19.11%, 19.13% and 19.28% respectively. Differences were also observed in the other nutrient compositions of the diet (Table 2).

Preparation of experimental house and facilities. General cleaning and disinfection of the experimental house were done two weeks before arrival of the chicks. Feeders, watering devices and sacks for curtains and dividers were washed. Rinsing with water under high pressure was done to ensure that all facilities were thoroughly cleaned. The cages were then divided into 12 pens following the PCAARRD Technical Bulletin Series no.10-A recommended space requirement which is one (1) square foot per chick. One hundred watts incandescent bulbs were installed in the cages to provide heat and light to the birds. Regular cleaning of the poultry house was done to ensure that birds were raised in a clean and comfortable environment throughout the experimental period.

The following were gathered from the study.

1. Weight (kg). This included the weights of the broilers at day 31 which served as the initial weights during the experimental period.

2. Final weight (kg). This was taken by weighing the birds per replicate at day 45 which was the end of the study.

3. Feed offered (kg). This was the amount of feed offered to the birds daily from day 31 to day 45.

4. Feed left-over (kg). This was the amount of feed not eaten by the birds daily from day 31 to day 45.

5. Feed cost (Php). This was the prevailing cost of feeds consumed by the birds at the time of the study.

6. Nutrient content of potato meal and experimental rations. Potato meal and experimental rations were submitted for proximate and energy analyses.

Computation of data gathered:

1. Gain in weight (kg)

a. Total Gain. This was computed by subtracting the initial weight from the final weight per replicate during the finishing period.

b. Daily gain. This was computed by dividing total gain by the experimental period of 15 days.

2. Feed Intake (kg)

a. Total feed intake (kg). This was computed by subtracting the amount of feed left-over from the amount of feed offered per replicate from day 31 to day 45.

b. Average daily feed intake (kg). This was the amount of feeds consumed daily per replicate and was computed by dividing the total feed intake by the total number of feeding days (15 days).

3. Feed conversion ratio. This parameter measures the amount of feed consumed to produce a

kilogram gain. It was computed by dividing the total feed intake by the total gain in weight per replicate.

4. Feed cost (Php) to produce a kg of broiler. This was obtained by multiplying the feed conversion ratio by the cost (in Php) per kg of feed per replicate.

5. Nutrient Content of Potato

Statistical Design and Analysis

Significant differences in all response variables were determined through Analysis of Variance (ANOVA) appropriate for Completely Randomized Design. Treatment means were compared using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSIONS

Initial and Final Weights and Weight Gain of Birds

The average daily gain in weight of the birds from 31 to 45 days in the different treatments are shown in Table 3. The initial mean weight of the birds from the different treatments were not signficantly different as the birds were of the same age at the start of the experiment and were subjected to the same care and management during brooding and growing periods. The mean initial weight of 31-day old broiler birds was 1.220 kg.

Statistical analysis showed significant differences among treatment means for the final weight of birds at forty-five days. The mean final weight of broilers given ration containing 10% potato meal was 2.062, 0.19 kg higher than the final weight (1.872 kg) of birds given 20% potato meal. The final weight of broilers given 0% and 20% potato meal did not vary significantly. The effect of the different levels of potato meal on the final weight is directly related to the gain in weight of birds from day 31 to day 45. There were significant differences in the daily gain in weight of the birds among treatments. Birds given 10% ration containing PM gained 12 g more per day than birds given 20% PM. The results indicate that giving ration containing 10% potato meal support faster growth of broiler and therefore is more beneficial to bird and poultry/broiler raisers.

Feed Intake, Feed Conversion Ratio and Feed Cost to Produce a kg Gain in Weight

Table 4 shows average daily feed intake, feed conversion ratio and feed cost to produce a kg gain in weight of broilers from 31 to 45 days of age using the different treatments. Based on the results, inclusion of 10% potato meal in broiler rations is favorable and this supports the finding of an earlier study of Atinyao and Quintol (2004) where the inclusion of potato meal in broiler rations resulted to higher daily gain and therefore higher final weight. The decrease in the daily weight gain and thus the final weight of broilers

Table 3. Average daily gain in weight from 31 to 45 days of age

TREATMENT	INITIAL WEIGHT (kg)	FINAL WEIGHT (kg)	DAILY GAIN (kg)
0% Potato Meal	1.208^{a}	1.962^{ab}	0.050^{ab}
10% Potato Meal	1.228^{a}	2.062^{a}	0.055^{a}
20% Potato Meal	1.225^{a}	1.872^{b}	0.043^{b}

Means with the same superscript are not significantly different (Pr>F) DMRT

Table 4. Average daily feed intake, feed conversion ratio and feed cost to produce a kg gain in weight of broil-ers from 31 to 45 days of age

TREATMENT	AVERAGE DAILY FEED INTAKE (kg)	FEED CONVERSION RATIO	FEED COST TO PRODUCE KG GAIN IN WEIGHT (PhP)
0% Potato Meal	0.147^{a}	2.93^{ab}	60.53
10% Potato Meal	0.148^{a}	2.66^{b}	59.53
20% Potato Meal	0.148^{a}	3.35^{a}	81.00

Means with the same superscript are not significantly different (Pr>F)DMRT

as the level of inclusion of potato meal was raised to 20% conforms with the finding of Band (2014) where increasing the amount of potato meal causes a decrease in live weight.

Statistical analysis showed no significant differences in the feed intake of broilers given rations with 0, 10% and 20% potato meal. This implies that the acceptability and palatability of the ration were not affected by the level of inclusion of the potato in broiler rations. The mean daily feed intake of birds across treatments was 0.148 kg.

Feed conversion ratio obtained through the division of the total feed intake by the total gain in weight was significantly different among treatments. Birds given ration containing 10% potato meal had better feed conversion ratio of 2.66. This is statistically similar to the study mentioned by Zobel and Schilling (1964), where feed intake of birds given 0% sweet potato meal (2.93) is much better than the FCR of birds given 20% sweet potato meal (3.35). This may imply a possible antinutritive effect, particularly of solanine, as level of inclusion of potato meal is raised from 10 to 20%.

Significant differences were observed among treatments in terms of the mean feed cost to produce a kilogram of broiler. The average feed cost across the treatments was Php 67.71 per kilogram of formulated feeds.

As to feed cost, results showed that birds given ration containing 10% potato meal had the lowest feed cost of Php 59.53 to produce a kg gain in weight, followed by birds given 0% potato meal (Php 60.53). The highest feed cost to produce a kilogram of broiler was obtained at 20% level of inclusion of potato meal (Php 81.00). The feed cost to produce a kg gain in weight was based on the feed cost per kg of feed of Php 20.66, Php 22.67 and Php 24.18 for rations containing 0%, 10% and 20%, respectively. Computation showed that feed cost per kg increased as the level of inclusion of potato meal was raised. However, the better FCR obtained, particularly at 10% level of inclusion, the more beneficial this was than the additional feed cost. In the computation of the feed cost, price of potato meal was higher than that of corn due to the processing cost. This may, however, be lowered if done in bulk.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There were no significant differences among the treatments in terms of the initial weight, average daily feed intake and feed cost. The average initial weight of birds taken at 31 days of age was 1.220 kg. The average daily feed intake across the treatments was 0.150 grams. Significant differences were observed in the final weight, daily gain in weight, and feed conversion ratio. Birds given ration containing 0% and 10% potato meal had higher final weights of 1.962 kg. and 2.062 kg. respectively. This was followed by birds given ration containing 20% potato meal with average final weight of 1.872 kg.

Birds given 0% and 10% ration containing potato meal had higher daily gains in weight of 0.050 kg. and 0.055 kg., respectively. Birds given 20% potato meal ration had a lower average daily weight gain of 0.043 kg. Birds given ration containing 10% and 0% potato meal had better FCRs of 2.66 and 2.97 respectively, followed by birds given ration containing 20% potato meal with an average FCR of 3.38. From these results, potato meal can be included in the finishing rations for broilers at the rates of 10%.

Recommendations

It is recommended that the performance of broilers given rations with potato meal in all phases of growth be evaluated.

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