Performance of Broilers Fed with Homemade Ration at Varying Levels of Oil Palm (*Elaeis guineensis* Jacq.) Kernel Meal as Substitute to Copra Meal

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DOI: 10.29322/IJSRP.9.11.2019.p9570
http://dx.doi.org/10.29322/IJSRP.9.11.2019.p9570

Abstract: Palm Kernel Meal has nutrient and amino acid composition comparable to that of copra meal except for higher lysine and methionine but it has been relatively underutilized and considered as agri-waste by-products. The study was conducted to investigate the potential of palm kernel meal (*Elaeis guineensis*) as a substitute to copra meal fed to broilers. Parameters considered in the study were average initial weight, average final weight, body weight gain, average daily gain, voluntary feed intake, feed conversion ratio, return above feed and chick cost and dressing percentage. Sixty broiler chicks regardless of sex were used as the experimental animal of the study. These birds were randomly distributed into five dietary treatments, replicated three times with four birds per replication. The five dietary treatments were Treatment 1-Homemade Ration without palm kernel meal (control); Treatment 2-Homemade Ration with 3.75 % palm kernel meal; Treatment 3-Homemade Ration with 7.50 % palm kernel meal; Treatment 4-Homemade Ration with 11.25% palm kernel meal and Treatment 5-Homemade Ration with 15% palm kernel meal. Data gathered were subjected to one-way Analysis Of Variance (ANOVA) in a Completely Randomized Design using Statistical Package for Social Science (SPSS) version 17.0 software. Results showed no significant differences in all parameters of the study. However, despite the short term duration of the experiment, the overall result and the return above feed and chick cost (RAFCC) disclosed a bright prospect of PKM substitution for broilers.

Index terms: broilers, copra meal, palm kernel meal, and growth performance

INTRODUCTION

Poultry production had grown rapidly due to its' unlimited demand for protein-rich food. It is one of the most productive and cheapest ways to provide nutritious food for human beings. Livestock and poultry industry in the Philippines is strongest in the agriculture sector of which most of the entrepreneurs dominate the poultry industry (PSA, 2017). Today, poultry raisers are facing a crisis due to the rising cost of feeds, antibiotics, labor, and infrastructure requirements. Birds if not fully supplied with medicines become vulnerable to disease and stress, thus, requiring expensive raising. An attractive alternative for today's mass-produced industrial chicken is broiler chicken (*Gallus gallus domesticus* Linn.). Broiler chicken has been highly selected for high growth rate, breast-meat yield and feed conversion efficiency. Specifically, these are raised for meat production under an intensive system using commercial feed ration. However, broiler production cost has increased significantly in recent years due to the price of feedstuffs (Gofredo *et. al.*, 2018). The same authors cited that the search for inexpensive, locally available and equally nutritive feedstuffs to partly substitute conventional poultry diets has never been more pressing. Broiler chickens require a certain amount of energy daily to satisfy their nutrient requirements, however, slower-growing birds will have greater total energy requirements because it takes longer days for them to hit market weight. This means more maize and soya beans to feed them, more fuel and transport emissions and more manure produced. This is not simply a cost factor, but it has major implications for the sustainability and environmental impact of poultry production as a whole, as demand for chicken continues to increase. (www.chickencheck.in, 2015).

The performance of the bird is dependent on the kind and quality of feed given as well as their water requirements. Feeds provide and satisfy the nutritional requirement while water plays an important role in metabolism, digestion, and thermoregulation of the body of the birds. It is a constant challenge for researchers to find a new locally available and nutritious feed to meet the nutritional requirements of the birds. Some prefer to do mixes into the feeds while others have it by adding and substituting through drinking water as an alternative means but would still satisfy the nutritional requirements. The challenge to solve such a crisis in production is one of the aims of animal producers and nutritionists to seek alternative sources of feedstuff that is effective and enough to meet the growing requirement of the birds with availability and cost as factors to think of. Palm Kernel Meal (PKM), a by-product of Oil Palm (*Elaeis guineensis* Jacq.) is considered to be an agro-industrial waste derived from the extraction process. PKM is widely used as source of protein and energy in various poultry and livestock animals such as laying hens (Chong, *et al.*, 2008), broiler chickens (Mardhati, *et al.* 2011), dairy cows (Carvalho, *et al.*, 2006), rabbit (Orunmuyi, *et al.*, 2006), and pigs. Several studies have been reported on the inclusion of varying levels of PKM in poultry diet and its effects on the performance parameters. In the Philippines, no report on the extensive use of this by-product has been published both in ruminant and non-ruminant, thus this study.

II. METHODOLOGY

Table 1. Composition and calculated analysis of experimental starter ration for broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

Feed Ingredients	Treatments				
	I	II	III	IV	V
	Control	3.75 % PKM	7.50 % PKM	11.50 % PKM	15% PKM
Home-made Ration	100	96.25	92.5	88.75	85
Palm Kernel Meal	0	3.75	7.5	11.25	15
Total	100	100	100	100	100
Price/kg (p)	21.89	21.38	21.08	20.78	20.48
Calculated Nutrient Analysis					
Crude Protein (%)	21.39	21.37	21.36	21.34	21.33
ME Kcal/kg	2747.80	2747.80	2747.80	2747.80	2747.80
Calcium	0.78	0.79	0.79	0.79	0.80
Phosphorus	0.45	0.47	0.49	0.50	0.52
Lysine	1.13	1.21	1.29	1.37	1.46
Fiber	5.60	5.60	5.60	5.60	5.60
Methionine	0.29	0.34	0.39	0.45	0.50
L-Tryptophan	0.19	0.19	0.19	0.19	0.19

2.1 Procurement of Experimental Birds

Sixty (60) day-old broiler chicks regardless of sex were used in the experiment. These day-old broiler chicks were purchased from a reliable source and placed at the Poultry house, College of Agriculture, Sultan Kudarat State University – Lutayan Campus, Brgy. Blingkong, Lutayan, Sultan Kudarat.

2.2 Preparation of Experimental Cages

One week before the arrival of the chicks, facilities were cleaned and disinfected to prevent the possible occurrence of diseases. The brooder pen was made of galvanized iron sheets with a dimension of 2 ft x 4.5 ft x 1.0 ft. This was cleaned and disinfected with commercially available disinfectant before the experimental birds were placed for brooding. After the brooding stage, the broiler chicks were transferred to grower cages with the recommended standard floor space requirement of 1 square foot per bird. The grower cages were constructed in elevated colony type pens and made up of local materials. The walling and flooring were made from bamboo slats. Provisions for proper ventilation and prevention of extreme cold weather conditions were also provided.

2.3 Brooding and Rearing Management

During the whole duration of the brooding period, old newspapers were used as beddings or litter and changed to prevent manure accumulation. Two 50-Watt electric bulbs were provided as a source of artificial heat until the time when they will be able to regulate their body temperature. The chicks were being fed with commercial booster mash during the whole duration of the brooding period (14 days).On the 15th day of brooding, the chicks were transferred to the grower cages and the standard experimental diet for broiler chickens were being followed.

2.4 Feeding and Water Management

The experimental birds were fed *ad libitum* to ensure that they are fed continually. At the brooding stage, the birds were given chick booster mash. However, on the 15th day, the experimental birds are fed with their respective experimental rations until the 35th day. The experimental homemade rations were given to chicks at 6:00 in the morning, 12:00 and 3:00 p.m., fed *ad libitum*. The homemade rations given were weighed and recorded. Separate feed containers were provided for every treatment and feed refuse was collected and weighed. Freshwater was provided throughout the feeding experiment.

2.5 Preparation of Homemade Ration

The homemade ration was prepared after purchasing all the ingredients. The Palm kernel meal was purchased from Kenram Palm Oil Industries Inc., Brgy. Kenram, Isulan, Sultan Kudarat these were dried then hammer milled before adding to the formulation. The maximum inclusion of feedstuff in the ration was considered based on the Philippine Recommends for Poultry and Livestock Feed Formulation.

2.6 Experimental Diet

The experimental treatments were as follows:

T1 - Homemade Ration without PKM (Control)
T2 - Homemade Ration with 11.25% CM and 3.75% PKM
T3 - Homemade Ration with 7.50% CM and 7.50% PKM
T4 - Homemade Ration with 3.75% CM and 11.25% PKM
T5 - Homemade Ration with 15% PKM

2.7 Slaughtering of Birds

A total of 15, 35 days old broiler chicken were dressed after 35 days of rearing and feeding homemade rations with varying levels of palm kernel meal as a substitute to copra meal. These were obtained from 60 broiler chickens raised in a growth performance study. The process included cutting of throat from the outside and near the mandible to cut the jugular vein and facilitate bleeding. With downward pressure, the knife was rolled with the left hand and immersed in the boiling water for 20 seconds, enough to remove the feathers.

III. RESULTS AND DISCUSSION

3.1 Average Final Weight

Presented in Figure 1 is the average final weight of broilers fed with homemade ration at varying levels of Palm Kernel Meal as a substitute to copra meal. Results revealed no significant differences (*p-value* = 0.210) among treatment means. The figure shows that the birds in Treatment 4 had the heaviest final weight of 1254.42 grams; followed by Treatment 2 with 1233.00 grams; Treatment 3 with 1200.25 grams;

Treatment 5 with 1195.17 grams and the lowest in Treatment 1 with 1134.08 grams. This result confirmed to the studies of Osei and Amo (1987) as supported by Onifade and Babatunde (1998) who reported that the addition of palm kernel meal had no significant influence on the body weight of broilers. This is, however, similar to the finding of Garcia *et al*. (1999), which stated that the body weight gain of broilers was slightly (< 0.05) higher when fed palm kernel meal diets at 10% than at 20% and 30% of the dietary rate. The results imply that birds fed with varying levels of PKM show a comparable result in the entire feeding period. Moreover, the use of PKM in the monogastric diet should be limited due to its high fiber content which can reduce the digestive enzyme's action (Ojewola and Ozuo, 2006)

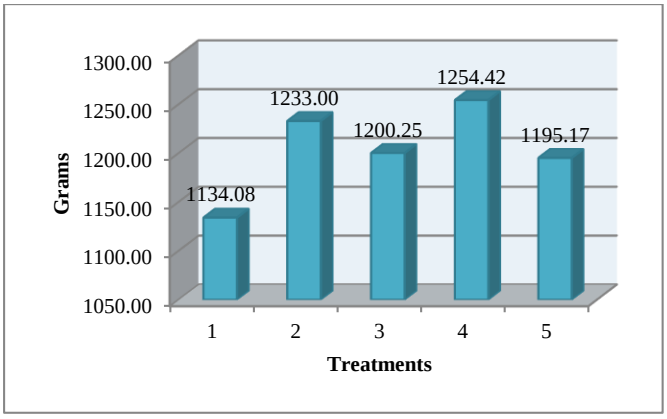

Figure 1. Average final weight (grams) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.2 Body Weight Gain

Figure 2 presents the average body weight gain of the experimental birds. Results showed no significant difference among treatment means. Treatment 4 had the highest weight gain of 975.42 grams followed by Treatment 2 with 955.83 grams; Treatment 3 with 914.00 grams; Treatment 5 with 910.17 grams and Treatment 1 with the least body weight gain of 839.08 grams. The result of the study agreed with Soltan (2009) who reported that during processing, Palm Kernel Meal may undergo Maillard reaction due to the heat applied and this adversely affects digestibility. This observation is similar to the study of Okuedo, *et al.*, (2006) who observed that dietary supplementation of PKM up to 30 % PKM did not affect the final weight and weight gain in broiler chickens. However, they observed that birds fed 45% above PKM had reduced body weight as shown in Figure 2.

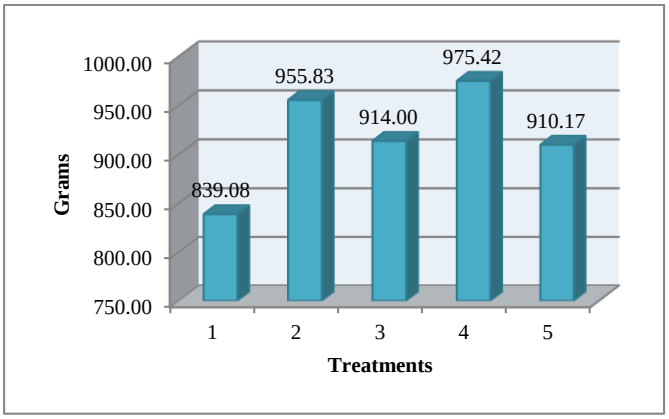

Figure 2. Average body weight gain of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.3 Average Daily Gain

Figure 3 shows the average daily gain (gram) of birds. Treatment 4 had the highest average daily gain of 46.45 grams compared to Treatment 2, Treatment 3, Treatment 5 and Treatment 1 which had 45.52 grams, 43.52 grams, 43.34 grams, and 39.96 grams, respectively. However, no significant differences were observed, indicating that homemade ration at varying levels of palm kernel meal could not affect the average daily gain of broiler chicken. It should be noted that broiler chicken in Treatment 4 fed with homemade ration generally obtained heavier gain in weight compared to the Control (without PKM), with 11.25%. Result confirmed to the study of Armas and Chicco (1977) that the inclusion of palm kernel in the ration can increase the gain in weight and growth performance of the broiler chicken.

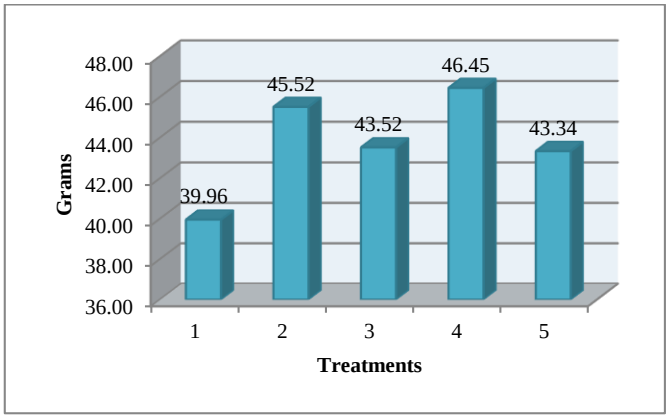

Figure 3. Average daily gain (grams) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.4 Voluntary Feed Intake

The voluntary feed intake of birds is shown in Figure 4. Results revealed no significant difference among treatment means. Treatment 3 had the highest feed consumption of 2023 .83 grams followed by Treatment 1 with2011.50 grams; Treatment 2 with 1948.50 grams; Treatment 4 with 1900.08 grams and Treatment 5 with the least feed consumption of 1881.92 grams only The result supports with Mateos, *et al.*, (2012) that during the starter period, feed rations containing Palm Kernel Meal had no significant effect on the voluntary feed intake of broiler chicken. Moreover, Walugembe, *et al.*, (2015) indicated that the use of high fiber ingredients in broiler diets does not affect growth performance. It was therefore not surprising that the high level of PKM did not have an adverse effect on the feed intake of broilers.

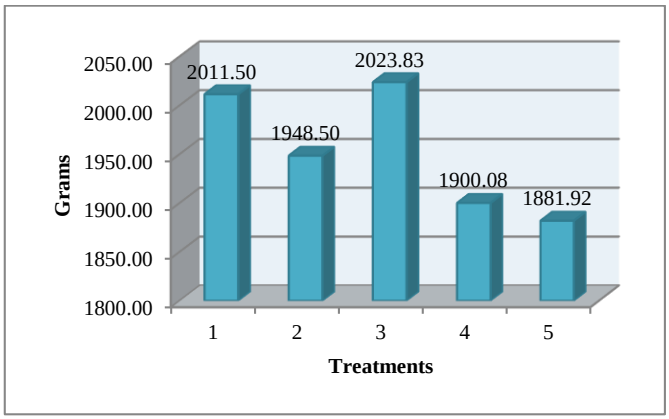

Figure 4. Average voluntary feed intake (grams) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.5 Feed Conversion Ratio

Feed conversion is the ratio between the total feed consumed over the total weight gained of the birds. The lower the value, the more efficient are the birds in converting feed to live weight. Results showed no significant difference among the treatment means for the feed efficiency of the birds.

Treatment 4 had the highest feed efficiency value of 1.95 kg; Treatment 2 with 2.05 kg; Treatment 5 with 2.09 kg; Treatment 3 with 2.22 kg and Treatment 1 with 2.41 kg. The result agreed to the study of Osei and Amo (1987) who reported that the addition of PKM in the diet did not significantly affect the feed conversion ratio. However, numerically, birds receiving a diet of 20% and 30% PKM diet have slightly better FCR. This observation was not similar to the study of Ojewola and Ozuo (2006) who found that the inclusion of 15% PKM has poor FCR for growing cockerels compared with the Control. This implies that the birds receiving different levels of PKM are more efficient numerically in converting feed into meat since they were not significant.

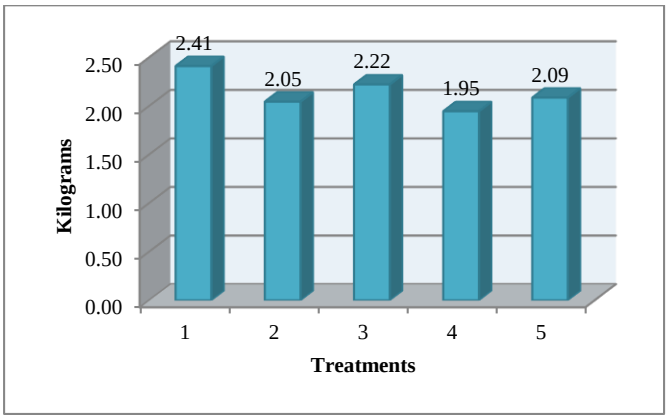

Figure 5. Feed conversion ratio (kilograms) of broilers fed with homemade ration at varying levels of oil palm kernel meal

3.6 Dressing Percentage

Figure 6 shows the results of dressed meat of broilers fed homemade ration which shows no significant difference among treatment means. Treatment 4 had the highest percentage of 71.60%, followed by Treatment 2 with 70.40%, Treatment 3 with 68.00%, Treatment 1 with 67.86% and Treatment 5 with the least dressing percentage with 66.60%. The results confirmed with the study of Okuedo *et al*. (2006) who observed that broiler chicken fed with varying levels of Palm Kernel Meal had higher dressing percentage compared to those at 0% inclusion of PKM in the ration, as presented in figure 6.

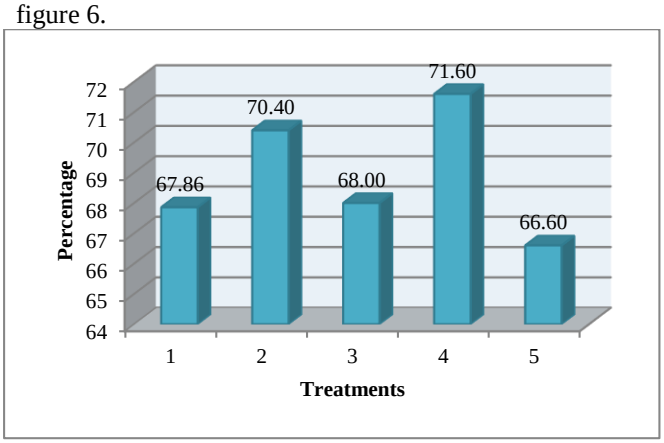

Figure 6. Dressing percentage (%) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.7 Return Above Feed and Chick Cost

The return above feed and chick cost refers to the amount gained using the treatment of the study. It shows that the given treatment had a positive or negative impact on profit gaining. Among the five dietary treatments, Treatment 4 with 11.25% PKM had the highest return of Php 81.33. This was followed by Treatment 2 with Php 76.60; Treatment 5 with Php 74.64; Treatment 3 with Php 71.21 and Treatment 1 with Php 61.21. This result supports the study of Osei and Amo (1987) who stated that using PKM considerably.

Table 2. Return above feed and chick cost of broilers fed homemade ration at varying levels of palm (*Elaeis guineensis*) kernel meal as a substitute to copra meal

PARTICULARS	TREATMENT				
	1	2	3	4	5
Final live weight, kg	1.134	1.233	1.200	1.254	1.195
Price/kg LW (Php)	130.00	130.00	130.00	130.00	130.0
Gross return/head (Php)	147.42	160.29	156.00	163.02	155.35
Cost of DOC/head (Php)	30.00	30.00	30.00	30.00	30.00
Feed Consumption (kg/head)					
a.CBM (kg)	0.37	0.37	0.37	0.37	0.37
b.Homemade ration (kg)	2.01	1.94	2.02	1.90	1.88
Price/kg of Feed (kg)					
a. CBM (kg)	33.00	33.00	33.00	33.00	33.00
b. Homemade ration (kg)	21.89	21.38	21.08	20.78	20.48
Total Feed Cost (Php)					
a. CBM (kg)	12.21	12.21	12.21	12.21	12.21
b. Homemade Ration (kg)	44.00	41.48	42.58	39.48	38.50
Total Cost (Php)	56.21	53.69	54.79	51.69	50.71
RAFCC	61.21	76.60	71.21	81.33	74.64

IV CONCLUSION AND RECOMMENDATION

The addition of palm kernel meal in broiler ration had no significant effect on the growth performance of broiler. However, the inclusion of Palm Kernel Meal in the homemade ration gave a higher return of investment in raising broilers. In light of the findings, the researcher recommends the incorporation of PKM in the diet of broilers to obtain higher profit. Likewise, further study on the use of PKM for a long duration of research should be done in ruminant or non-ruminant animals.

ACKNOWLEDGMENT

The authors acknowledge Snowie Jane C. Galgo, Professor Nathaniel D. Naanep and the university veterinarian Dr. Ne B. Velasco for their insights, comments, and suggestions on the conduct of the research.

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