

PALM OIL SLUDGE AS ENERGY SUBSTITUTE IN FINISHER BROILER DIETS

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Abstract

The high cost of energy feed ingredients has pushed feed prices to astronomical levels thereby making cost of mature broiler chickens out of reach of the average consumer. In a bid to keep poultry producers in business the search for cheaper alternative feed ingredients would continue to ensure that consumers have access to live chickens at affordable costs. This experiment investigated the effect of different levels of inclusion of Palm oil sludge in the diet of finisher broiler birds. One hundred and twenty 4 week-old birds of the Ross 308 strain were randomly allotted to four treatment diets of 30 birds each in a completely randomized design with three replications of 10 birds each. The four diets were formulated such that palm oil sludge replaced maize at 5, 10 and 15% respectively, designated as T₂, T₃ and T₄. The control treatment T₁ contained no palm oil sludge. The experiment lasted for 28 days. The results showed that the birds on T₄ recorded significantly higher weight gains, better feed conversion ratio, reduced feed intake and lower feed costs when compared to the other treatments. It can be concluded that inclusion of Palm oil sludge at 15% in finisher broiler diet resulted in increased weight gains and cheaper feed cost which is therefore recommended for adoption by farmers and feed millers in this era of exorbitant cost of feed and mature broiler birds.

Keywords: cost efficiency, energy, south eastern Nigeria, palm oil industry

Introduction

The quest for food security for the teeming world population has been a top priority of governments around the world. FAO (2022) notes that the world is moving backwards in its efforts to end hunger, food insecurity and malnutrition in all its forms due to conflict, climate extremes, economic shocks combined with high cost of nutritious food. It is estimated that the number of malnourished people of the world grew by 150 million people between 2019 and 2022, after a decade of steady decline. Animal protein in the form of meat, milk and eggs remain a very vital part of the food security equation especially in sub-Saharan Africa hence its potential to improve access to good nutrition for adults and children under 5 years cannot be over emphasized. In order to meet this target, food production must be intensified and nations around the world must promote coordinated and focused policy action in this regard. It is only by aligning efforts and strengths that countries can wipe out the root causes of what make the poor food insecure, malnourished and trapped in a vicious circle of chronic deprivation (FAO 2022). Poultry meat from broilers represent a veritable source of filling the animal protein supply gap due to their fast growth and high turn-over rate but is challenged by exceedingly high feed costs. Cereals constitute the major energy feedstuff and also make up more than two thirds of the finished feed for different classes of poultry. However, the high cost of conventional energy sources such as maize and cassava, sorghum, and millet due to high competition from food and beverage industries has created higher demand for the “conventional” by-products from these industries for livestock feeding. As a result, by-products of food and beverage industries, which were hitherto cheap and easily affordable have experienced astronomical rise in prices as well. This has challenged nutritionists to continue the search for cheaper and more suitable alternatives. In the south east of Nigeria, palm fruit processing for oil palm production is a major industrial activity and produces a by-product after the extraction of the oil known as palm oil sludge. (POS). Palm oil sludge is the material that remains after the sterilisation and clarification processes and the resulting decanting of the oil during the milling of the oil palm fruit. It is a semi solid mass considered as mill effluent which could sometimes pose environmental issues when discharged into the surrounding ecosystem. Its nutritional contents are comparable to maize in terms of energy and protein contents. It has a crude protein (CP) of 96 g/kg and metabolisable energy (ME) of 17.76 MJ/kg (Devendra, 1977). This makes it relatively perfect match to maize with 90 g/kg CP and 14.37 MJ/kg. Feedipedia (2016) reported DM 68.4%, ME 23 MJ/kg, Crude protein 11%, crude fibre 7.9%, NDF 28.2%, ADF 22.1%, ether extract 29.2, ash 8.7% reported Hertrampf (1988) reported that palm oil sludge (POS) in place of maize at a level of 15 to 30% increased the daily feed intake and the average daily weight gain of pigs in addition to a significant reduction in feed cost. Bobadoye *et al.*, (2006) reported improved growth performance of broilers fed palm oil sludge.

Despite the huge potential of the POS as a credible energy alternative, their inclusion in broiler finisher diets is not popular and has not been widely reported especially in south east Nigeria. Hence this study investigated the effects of inclusion of enzyme supplemented POS at different levels in broiler finisher diet.

Materials and Methods

The experiment lasted for 4 weeks and was carried out at the Teaching and Research Farm of the Department of Animal Science and Technology, Federal University of Technology, Owerri, Imo State. Imo State lies between latitude 4° 4' and 6° 3' N, and longitude 6° 15' and 8° 15' E. Owerri is about 100m above sea level with mean annual rainfall of 2500 mm, temperature range of 26.5 – 27.5 °C, and humidity range of 70 – 80%. Dry season duration (months with less than 65 mm rainfall) is three months, which takes place during the months of December, January and February. The palm oil sludge (POS) used for this study were collected from a small scale palm oil mill at Umugwo, Ohaji Local Government Area, Imo State, Nigeria. The POS sludge was collected in a jute sack and left for two weeks to drain excess water. The resulting semi-solid mass was sun-dried on a clean concrete slab to achieve dry crumbs with reduced moisture content. The dried crumbs were then milled using hammer mill to obtain smooth particles suitable for inclusion as feed ingredient.

A Multi-enzyme complex known as Maxigrain, containing; cellulase, beta-glucanase, xylanase, and phytase was used for the experiment was purchased from feed dealer in Owerri, Imo State.

Experimental diets

Four experimental diets namely T₂, T₃ and T₄ were formulated to contain 5 %, 10 % and 15% of palm oil sludge respectively and a control diet T₁ without POS inclusion, The experimental diets were supplemented with exogenous enzymes at 0.5% each. Clean water and feed were freely supplied to the animals throughout the experiment.

Table 1. Composition of experimental diets

Ingredients	T₁	T₂	T₃	T₄
Maize Offal	55.00	50.00	45.00	35.00
Palm oil sludge	0.00	5.00	10.00	15.00
PKC	10.00	10.00	10.00	10.00
Wheat offal	18.00	18.00	18.00	18.00
Soybean Meal	13.00	13.00	13.00	13.00
Bone meal	3.20	3.20	3.20	3.20
Vitamin premix*	0.25	0.25	0.25	0.25
NaCl	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Exogenous enzymes		0.5	0.5	0.5
Metabolizable energy	2901.66	2935.40	2970.67	3004.44
Crude protein	20.08	20.33	20.67	20.99
Vitamin premix* Vit. A-10,000,000 iu, Vit. D3-2000,000iu, Vit.E-20,000mg, Vit B1-3,000mg, Vit B2-5,00mg, Vit B6-4,000mg, Vit B12-20mg, Niacin-45,000mg, Calcium Pantothonate-10,000mg, Choline Chloride-300,000mg, Folic Acid-1,000mg, Biotin-50mg, Manganese-300,000mg, Fe-120,000mg, Zn-80,000mg, Cu-8,500mg, Iodine-1,500mg, Cobalt-300mg, Selenium-120mg, Anti-Oxidant-120,000mg,				

Experimental birds and management

One hundred and twenty 4-week -old broiler birds of ROSS 308 strain were randomly allotted to four treatment groups each with three replication. Each treatment group had 30 birds with 10 birds per replicate. Birds were housed in a deep litter pen covered with wood shavings. Routine vaccination and medication schedule was strictly followed throughout the duration of the experiment. Data collected

were feed intake, final weight gain, daily weight gain, feed conversion ratio and feed cost per Kg of feed.

Results of the growth performance indices and other parameters were subjected to Analysis of Variance using the Proc GLM procedure of SAS 2002 and means were separated using Duncan New Multiple Range Test.

Results and Discussion

There were significant differences ($P < 0.05$) in final weight among treatment means with T₄ recording the highest gain weight while results were similar for T₃, T₂ and T₁. The increase in final weight gain as the level of inclusion of palm oil sludge increased could be attributed to the higher energy contents of the test diets and the presence of exogenous enzymes. This is consistent with Yunana *et al.*, (2019) who reported that broilers fed higher energy diets performed better during the finisher phase with significantly higher final body weight gain. The inclusion of exogenous enzyme in the diets containing palm oil sludge have been shown to improve performance and nutrient digestibility (Saleh *et al.*, 2003). Daily feed intake was significantly ($P < 0.05$) lowest in T₄ followed by T₃ and then T₂. The control (T₁) recorded the highest feed intake. The decreased daily feed intake for birds on T₃ to T₄ could be due the higher energy levels in T₃ and T₄. Higher energy level in feed has been reported to decrease feed intake since the birds have adequate supply of energy hence a reduction in feed intake (Coon *et al.*, 1981).

Birds in T₄ recorded a significantly ($P < 0.05$) better feed conversion ratio than birds in the other treatments. There were no significant ($P > 0.05$) differences between birds on control diet (T₁) and T₂ a T₃. The better feed conversion ratio in birds on diets containing palm oil sludge could also be attributed to the addition of exogenous enzymes in the diets which may have aided the digestion of feed thereby making more nutrients available for absorption. This could also be due to the higher energy contents of feed as corroborated by Coon *et al.*, (1981) who reported superior feed conversion ratio in broilers on higher energy diets. Daily weight gain was numerically higher for birds in T₄ though not significant ($P > 0.05$). This could also be attributed to the highest energy content of T₄ diet as reported by Yunana *et al.*, (2019)

Feed cost/Kg and feed cost/100kg differed significantly different ($P < 0.05$) among treatment means with T₁ having the highest cost followed by T₂, T₃ and then T₄. Also cost/kg weight gain for T₁ and T₂ also showed no significant ($P > 0.05$) difference. T₁ had a significantly ($P < 0.05$) higher cost/kg weight gain than those in T₃ and T₄. Birds on T₂ had similar ($P > 0.05$) value with those in T₃ but differed significantly ($P < 0.05$) from birds on T₄, which had a similar cost /kg weight gain with T₃. The decrease in feed cost/kg and cost/100kg from T₁ to T₄ was due to the reduction in total cost of maize following the inclusion of the palm oil sludge. Four mortalities were recorded during the period of the experiment; one mortality was recorded in T₁ (control), two mortalities recorded in T₂ and one mortality recorded in T₃. There was no evidence to indicate that the mortality were as a result of the inclusion of palm oil sludge in the diet since the T₁ also recorded mortality and there was no mortality in T₄.

Table 2. Growth performance characteristics of finisher broilers fed varying level of Palm oil sludge.

Parameter (g)	T1	T2	T3	T4	SEM
Initial weight	1116.4	1166.5	1190.47	1144.67	43.66
Final weight	2253.33 ^{ab}	2310.00 ^{ab}	2310.00 ^b	2416.67 ^a	43.75
Weight gain	1137.0	1143.5	1009.5	1272.0	73.83
Daily weight gain	40.60	40.84	36.05	45.42	2.53
Daily feed intake	172.29	161.79	166.93	170.26	1.35
Feed conversion ratio	4.31	3.98	4.63	3.75	0.054
Feed cost/Kg	225.2	219.2	213.20	207.4	2.01
Feed cost/100 Kg	22523	21932	21323	20739	20.01
Cost/Kg weight gain	868.94	759.45	975.71	611.43	27.4

^{a, b}, Means within a row with different letter superscripts differ significantly (P<0.05)

Conclusion and recommendation

The result of this study has shown that the inclusion of enzyme supplemented palm oil sludge at 15% significantly improved growth performance indices such as weight gain, feed conversion ratio as well as reduction in feed cost thereby reducing the cost of broiler production. It is recommended that further research should be carried out on higher level of inclusion of palm oil sludge since palm oil sludge at 15% inclusion level did not show any deleterious effect rather it improved growth performance indices measured.

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