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Study on the growth performance and nutrient utilization of broiler chicken fed on partially maize replaced diet with palm oil (*Elaeis Guineensis*) sludge

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Abstract

A feeding trial was carried out to elucidate the effect of replacing maize with palm oil sludge (POS) on the growth performance and nutrient utilization of broiler chicken. A total of 200 broiler chickens, day old of either sex, were randomly allotted to four dietary treatment groups as per completely randomized design. POS was incorporated in the experimental diets at 0(Group-1, control), 10%(Group-2), 15%(Group-3) and 20 % (Group-4) to replace maize as energy source. Birds of each group were fed as mash form for duration of 6 weeks.

In the trial final body weight, feed conversion efficiency (FCR), Average Daily gain (ADG) (g/bird), weekly body weight gain (g/bird) and daily feed intake (g/h/d) was not significantly ($P>0.05$) effected up to 20% palm oil sludge based diets. Although, there was an increase in feed intake although not significantly ($P>0.05$) with increased levels of POS in the ration and FCR reduces proportionately with increasing palm oil sludge inclusion but insignificant ($P>0.05$) statistically.

It may be concluded that replacement of maize up to 20% with POS in the concentrate diet of broiler chicken had no effect on the growth performance and nutrient utilization. Economically, replacing maize with POS was cost effective and can be an alternative for costly feed ingredients in poultry production.

Keywords: Palm oil sludge, growth performance, nutrient utilization, broiler chicken

1. Introduction

Palm oil sludge is the material that remains after decanting the palm oil mill effluent (Devendra *et al.*, 1992) ^[5]. Palm oil sludge has a crude protein of 9.6% and metabolizable energy of 4245kcal/kg (Devendra, 1977) ^[4]. This makes it relatively comparable to maize with protein content of 9% and metabolizable energy of 3434kcal/kg.

Study by Habib *et al.* (1997) ^[8] showed that POME contain organic and essential nutrient which may be used to grow micro-algae as natural food for aquatic organism and it could be used as fertilizers and animal feeds Wu *et al.* (2007) ^[13].

With the increasing cost of feed ingredients is a serious constraint for poultry production as it directly competes with humans for cereal grains. Therefore, unconventional feed resources can be an alternative as total or partial replacement of important feed ingredients in feeding of poultry birds where it is locally available in abundance. Utilizing such unconventional feedstuffs will be relatively cheaper and can be a solution to reduce the cost of production. Therefore, this study was attempted to evaluate the effect of feeding POS as partial replacement of maize on the growth performance and nutrient utilization of broiler chicken.

2. Materials and methods

The research work was carried out in the Instructional Livestock Farm of the College of Veterinary Sciences & Animal Husbandary, Selesih, Aizawl.

2.1 Experimental design and management:

A basal diet of 23% crude protein for pre-starter, 22% crude protein for starter and 20% crude protein for finisher was formulated. The maize was then replaced with the palm oil sludge at the rates of 0%, 10%, 15% and 20% in diet-1, diet-2, diet-3 and diet-4, respectively. The diets were calculated to similar levels of calculated ME and CP as per specification mentioned in BIS (2007).

During the 42 days feeding trial, a total of 200 numbers of day old broiler chickens of either sex was randomly distributed into four groups of fifty (50) birds each. In each group, there were 5 replicate with ten (10) birds each. Each group was randomly divided into four dietary treatment groups of five replicates to study the effect of Palm oil sludge on growth

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performance and nutrient utilization of broiler.

Birds were raised under deep litter system of management. They were subjected to standard management and health practices. Drinkers was washed daily and fresh feed and water was served daily *ad libitum*. After taking the body weight, birds were randomly allocated to dietary treatment in which 0, 10%, 15%, 20% of Maize was replaced on a weight for weight basis with sludge in a mash form. The birds were fed twice daily at 6:00 am in the morning and 4:00 pm in the evening.

2.2 Chemical and statistical analysis

The dry matter, crude protein, ether extract, crude fibre, nitrogen free extract and total ash in POS, feed and digesta were analyzed using standard methods (AOAC, 2000) [1]. The data were analysed using general linear model procedure of statistical analysis system (SAS, 2003) [12] for discussion, interpretation and result.

3. Results and discussion

3.1 Effect of partially replacing maize by palm oil sludge on daily feed intake (g/h/d) of broiler birds

Table 1: Effect of partially replacing maize by palm oil sludge on daily feed intake (g/h/d) of broiler birds

Weeks	G 1 (g)	G 2 (g)	G 3 (g)	G 4 (g)	Average ±S.E	P Value
1 st	17.31±0.39 ^a	17.26±0.044 ^a	16.77±0.119 ^a	18.03±0.078 ^b	17.34±0.63	0.005**
2 nd	35.47±1.29	36.40±1.02	36.23±0.90	33.71±0.68	35.45±2.32	0.249
3 rd	52.29±1.77 ^a	56.07±2.63 ^{ab}	62.58±1.24 ^c	58.51±1.64 ^{bc}	57.36±1.22	0.011*
4 th	107.51±2.47 ^a	93.85±4.82 ^b	103.63±1.91 ^{ab}	99.36±2.78 ^{ba}	101.09±1.87	0.045*
5 th	132.65±5.02	129.17±6.88	131.64±5.92	138.23±1.80	132.92±2.53	0.699
6 th	152.57±4.61	152.18±4.79	160.45±7.025	164.47±3.4	157.42±2.64	0.282
Ave ± SE	82.96±4.18	80.82±4.04	85.21±4.24	85.38±4.39	P = 0.854	

Values with different superscript in same row differ significantly ($P < 0.05$ and $P < 0.01$)

Table 1 shows the effect of partially replacing maize by palm oil sludge in broiler pre-starter, starter and finisher ration on the average daily feed intake (g/h/d) by the experimental birds.

Average daily feed intake did not differ significantly ($P > 0.05$) among the four experimental groups during the six week feeding trial. There was increase in feed intake although not significantly ($P > 0.05$) with increased levels of POS in the ration. Similar findings relevant to present study was observed by Hertramp (1988) [9]. The increase in feed intake with increasing levels of palm oil sludge in the diet may be as

a result of improvement in taste or palatability of the diets.

Oloredo and Longe (1999) [11] reported that supplementation of palm oil in broiler diet had improved feed intake which is relevant to the present study.

3.2 Growth performance of broilers fed palm oil sludge at different levels

3.2.1 Effect of partially replacing maize by palm oil sludge on weekly body weight gain (g/bird) of broilers

The weekly body weight gain (g/bird) of broilers from 1st to 6th week is presented in table 2.

Table 2: Effect of partially replacing maize by palm oil sludge on weekly body weight gain (g/bird) of broilers.

week	G 1 (g)	G 2 (g)	G 3 (g)	G 4 (g)	P value
1 st	55.96±2.16	56.03±2.1	56.17±3.26	54.15±2.35	0.938
2 nd	155.07±7.13	153.42±7.24	155.9±8.21	156.38±5.67	0.992
3 rd	277.36±12.15	279.52±14.78	279.96±13.40	276.95±10.47	0.998
4 th	451.79±15.49	450.79±17.53	450.63±19.20	453.46±22.93	1.00
5 th	511.35±25.35	506.75±26.10	540.72±24.65	509.03±30.85	0.787
6 th	542.62±27.34	521.64±32.26	546.27±36.94	582.65±36.83	0.636
Ave ± SE	332.36±16.57	328.03±16.62	338.27±17.55	338.77±18.05	0.966

Inclusion of palm oil sludge at different level did not have a significant ($P > 0.05$) effect on the final body weight of the broilers. Similar observation was reported by Faradonbeh *et al.*, (2011) [7]. They reported that initial weight, final weight, total weight gain and average weight gain were not significantly ($P > 0.05$) effected even up to 40% palm oil sludge based diets. The finding of the present study is in clear agreement with the finding of Faradonbeh *et al.*, (2011) [7].

In the present study the birds with palm oil sludge in their diet could maintain growth, probably, due to high content of CP in the palm oil sludge.

3.2.2 Initial and final body weight, FCR and ADG of the experimental birds

The average initial and final body weight, feed conversion ratio (FCR) and average daily gain (ADG) of the broilers are presented in table 3.

There was no significant difference ($P > 0.05$) in the initial body weight as well as final body weight among all groups.

Faradonbeh *et al.*, (2011) [7] also reported that final body weight of broiler chicken was not significantly ($P > 0.05$) effected up to 40% palm oil sludge based diets. Finding of Faradonbeh *et al.*, (2011) [7] supports the finding of the present study.

The Mean ± S.E value of FCR of broilers with palm oil sludge at different levels showed no significant ($P > 0.05$) difference. Although not significantly, with increasing level of palm oil sludge FCR tend to decrease, which probably maybe due to higher crude fibre. Since fibre level in diet is inversely proportional to digestibility, therefore FCR reduces proportionately with increasing palm oil sludge inclusion but insignificant ($P > 0.05$) statistically.

Faradonbeh *et al.*, (2011) [7] also showed that feed conversion efficiency was not significantly ($P > 0.05$) effected with the inclusion of palm oil sludge in the treatment groups. This report clearly supports the finding of the present experiment.

Boateng *et al.*, (2008) [2] also stated that feed conversion efficiency significantly declined as palm kernel cake levels

reached 12.5% and above.

Palm oil sludge at different levels did not show any significant ($P>0.05$) effect on average daily gain (g/day). Similarly, Faradonbeh *et al.*, (2011) [7] showed that average daily gain (g/day) was not significantly ($P>0.05$) effected with the inclusion of palm oil sludge in the treatment groups. Bobadoye *et al.*, (2008) [3] also showed similar result relevant

to present study.

In the present study the ADG (g/day) of broilers was not significantly affected with the inclusion of POS which contains, relatively, a high amount of crude fibre as shown in Table 4. This may be due to increase in the palatability of the diet with the inclusion of POS thereby getting the required energy by the birds to maintain growth rate.

Table 3: Performance of broilers fed palm oil sludge at different levels by partially replacing maize.

Attributes	G1	G2	G3	G4	P value
Initial body weight (g)	54.92±0.64	55.61±0.79	54.02±1.53	54.73±1.03	0.767
Final body weight (g)	2049.1±24.1	2023.78±26.39	2083.69±21.02	2087.37±32.32	0.272
FCR	1.84±0.043	1.88±0.056	1.96±0.074	1.94±0.075	0.526
ADG (g/day)	47.47±2.36	46.86±2.37	48.32±2.51	48.39±2.57	0.966

3.3 Effect of dietary treatment on nutrient digestibility

Nutrient digestibility of Dry matter, Crude fibre, Ether

extract, Crude protein and Nitrogen Free extract are presented on the Table 5.

Table 4: Chemical composition of palm oil sludge (POS)

On DM basis	POS
DM%	90.75
CP%	14.13
EE%	10.62
CF%	18.11
TA%	20.69
NFE%	36.45

Table 5: Effect of dietary treatment on nutrient digestibility

Parameters	G1	G2	G3	G4	P value
Dry matter%	73.88±1.06	71.55±1.62	71.53±1.72	71.38±1.80	0.629
Crude protein%	78.40±1.53	78.23±1.13	77.74±1.34	77.54±0.72	0.954
Crude fibre%	52.63±2.07 ^a	50.35±2.50 ^a	49.23±1.69 ^b	48.25±1.56 ^b	0.032*
Ether extract%	73.36±1.43	72.04±1.28	71.62±1.72	70.61±1.77	0.664
Nitrogen free extract%	72.11±1.35	71.44±1.73	71.28±1.06	70.51±1.92	0.911

Values with different superscript in same row differ significantly ($P<0.05$)

High fiber content in diet affects digestibility and since palm oil sludge have high fibre (table 4), with increased level of inclusion the fiber level increased in the diet. Thus with increased level of inclusion of palm oil sludge digestibility was affected, showing lowest in group-4, where 20% replacement was made. Although crude fiber digestibility showed significant ($P<0.05$) difference but other digestibility parameters were not significantly ($P>0.05$) affected. Decreased digestibility with increased level of palm oil sludge in diets in all attributes i.e. dry matter, crude protein, ether extract and nitrogen free extract was evident but not statistically significant ($P>0.05$).

The digestibility observed during this experiment showed similar results obtained by Mertenz (2009) [10]. He reported that the high Crude fiber, NDF, ADF and lignin content would decrease the digestibility. But in contrast other

parameters showed no significant result as found in a study in Muscovy ducks (Fadil *et al.*, 2014) [6]. He reported that inclusion of 35% palm kernel cake decreased ($P<0.05$) the dry matter, energy and crude protein digestibility compared to 15% and control group. He attributed this reduction to the shorter digesta passage time in 35% PKC fed birds.

3.4 Economics

The economics of production as presented in Table 6 shows that the average total feed cost was highest for control diet. Economically, there were distinct advantages of substituting palm oil sludge for maize as cost reduction between the control and palm oil sludge containing diets were Rs. 1.28/-, Rs. 1.74/- and Rs. 1.96/- for diets, 2, 3 and 4, respectively. Cost reduction was, therefore, achieved from POS substitution and better economic returns were obtained.

Table 6: Economics of broiler production

Diets	%maize replaced	Cost of feed /kg (Rs)	cost reduction per kg feed (Rs)	Av. total feed intake(kg)	Av. total feed cost (Rs)	Av. total wt. gain (kg)	cost of feed/kg weight gain (Rs)
G1	0	37.82	0	3.48	131.79	2.02	64.99
G2	10	36.54	1.28	3.39	124.03	2.02	61.28
G3	15	36.08	1.74	3.57	129.13	2.09	61.50
G4	20	35.86	1.96	3.58	128.6	2.06	62.23

Similarly, Bobadoye *et al.*, 2008 [3] reported that control diet had showed highest feed cost and decreased with increasing levels of dietary palm oil sludge in diets of broiler birds containing 10%, 20%, 30% and 40% palm oil sludge, respectively.

4. Conclusion

From the above study, it may be concluded that:

- 1) Palm oil sludge can be used in broiler ration by partially replacing maize grain without causing adverse effect on the performance of the birds. Palm oil sludge was not found to have any deleterious effect on broilers even at 20% level of inclusion as a substitute of maize.
- 2) Inclusion of palm oil sludge in the broiler diet did not influence the digestibility of dry matter, crude protein, ether extract and nitrogen free extract.
- 3) The cost of production for palm oil sludge treated birds is found to be lower than the control group.

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