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Full Length Research Paper

Performance and carcass yield of barrows fed dried poultry waste as a replacement for palm kernel cake

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Performance characteristics and carcass yield obtained from barrows (castrated male pigs) fed a diet in which dried poultry waste (DPW) totally replaced palm kernel cake (PKC) was investi-gated. The DPW diet was inferior in terms of total weight gained (30.8 kg as opposed to 34.2 kg for the PKC diet). The daily weight gain and efficiency of feed utilization were also better in the PKC diet (610.70 g versus 550 g and 0.318 versus 0.288, respectively). The carcass yield is 43.57 and 41.39 kg in the PKC and DPW diets, respectively. However, the DPW diet showed a lower feed cost per kilogram of the diet and gave higher monetary returns per kilogram of meat produced. Also this study revealed that using DPW to fatten pigs up to 60 kg resulted in a net saving of ₦196.00 per pig. The inclusion of DPW at this level in the growers' ration for pigs could therefore be beneficial in terms of reduction of feed cost and higher returns per kilogram of meat produced.

Key words: Performance, dried poultry waste, carcass yields, barrows.

INTRODUCTION

The Nigeria livestock industry is waging a continuous war of survival in the face of perennial scarcity and astronomical price of conventional feed ingredients. Ogunfowora (1984) speculated that the feed cost alone account for over 70% of the total cost of livestock production under intensive management. The high cost of the conventional feed ingredients coupled with the competition between man and his livestock for their use has necessitated a more determined search for the unconventional feed resources utilization in livestock rations.

The use of poultry waste as a protein supplement for livestock has been investigated in developed countries (El-Sabban et al., 1970; Evans et al., 1978; Kalch, 1980) and in Nigeria (Ibeawuchi et al., 1993; Belewu and Adeneye, 1996). Most of these researchers concluded that the utilization of poultry waste might be a viable option for the reduction of feed cost in livestock production at least in the developing countries. Another point in support of the utilization of poultry wastes is its potential to solve the somewhat nagging environmental problems that cannot be divorced from any livestock enterprise i.e. the disposal of animal wastes. According to Day (1975), animal waste management is not a glamorous subject. Bentley (1975) opined that disposal of animal wastes is a costly and highly demanding chore while Komegay et al. (1977) concluded that it is laced with environmental problems. Solutions to these environmental problems have been advanced through different options like composting the waste to produce organic manure, production of biogas and fertilization of fish ponds with these wastes. Incorporation of these wastes into practical livestock diets has also been canvassed as a way out of its inherent environmental problems (Eusebio, 1980)

There have been conflicting reports about the utilization of poultry waste in livestock rations. Further research to clarify this ambiguity will therefore not be out of place. Much of the research work on DPW in Nigeria has been conducted on ruminants which have the capacity to utilize the abundant non-protein nitrogen (NPN) in DPW better than the monagastrics. Also, there has not been any reported research work conducted to our knowledge on the use of this class of pigs (barrow) on feeding trials involving poultry wastes. With the full knowledge that barrows are uniquely designated for fattening and finishing for the pork or bacon industries, it would therefore be expedient to explore the possibility of raising them cheap-

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Table 1. Gross composition of the experimental diets (as fed basis)

Ingredient	Treatment I	Treatment II
Maize	55.5	52
Fish meal	2.5	3
Soybean med	12.5	9
Dried poultry waste	-	15
Palm kernel cake	15	-
Wheat bran	11.8	18.3
Oyster shell	0.5	0.5
Bone meal	1.5	1.5
Premix *	0.2	0.2
Salt	0.5	0.5
Total	100	100
Crude protein %	16.67	16.74
M.E. kcal/g	2.864	2.921

* Premix supplied 1 kg of feed: Vit A. 6,600 I.U. Vit. D_3: 660 I.U., Vit E. 88 I.U Vit. K.4.4mg Vit B_{12} 35.2 µg. Riboflavin 8.8 mg, Pantothenic acid 24.2mg, Niacin 38 mg, Choline Chloride 16.5mg, Mn. 4mg, Fe 18 mg, Zn 20mg, Cu 16mg, I 0.07mg and Se 0.06mg.

ly on poultry wastes.

MATERIALS AND METHOD

Location of study

This experiment was carried out at the Piggery Section of Songhai Farm, Portonovo in the Republic of Benin. This site is of the hot wet equatorial type of climate with a bimodal rainfall pattern. The total annual rainfall is about 1,800mm while the annual average temperature is about 26°C. There are two distinct seasons: the dry season which starts from November and lasts till February and the raining season which starts from March and lasts till October.

Preparation of dried poultry wastes

The poultry waste used for this trial was collected from the layers' unit of the farm. The layers were housed inside battery cages. Prior to the collection of the waste, old droppings were removed and clean polythene sheets spread in the shallow pit where the droppings normally fall. The spreading of these sheets was done very early in the morning (06 hours). Droppings that accumulated between 06 hours and 12 hours were collected daily. All collections per day were pooled and cooked in steel drums of 500 litres capacity. Four such drums were employed and the cooking time was two hours per collection per day.

Sun drying was done daily by spreading the waste on polythene sheets. Flies were screened off by mounting a large sheet of mosquito net at about 30 cm above the waste while the loose ends trailing on the ground were securely made fly-proof with a combination of pegs driven into the ground and adhesive tapes. Turning of the waste to ensure quick drying was done at regular intervals per day with improvised broom mounted on a short wooden handle. The entire drying period took one week. The dried poultry waste was subsequently milled and kept in bags prior to its incorporation into grower's pig ration.

Management of experimental animals

Eight crossbred (Large White x Pietrain) grower pigs of an average weight of 25.35 kg were used in this trial. All the pigs were obtained from sows that were synchronized and farrowed within three days to each other. They were castrated at two weeks of age and were batch-weaned when they were eight weeks old. Random selection of animals for this experiment was effected from this batch. The animals so selected were dewormed once at the start of the experiment with paranterel palmoate mixed with their feed. The animals were fed with the treatment diets for a week to enable them adjust to the feed before actual collection of data commenced.

Pigs were fed 5% of their body weight throughout the trial period which lasted eight weeks. The diets were given to the animals in weighted quantity daily at 0800 hour and 1500 hour throughout the period. Water was given *ad libiturn* daily. Faeces was collected and disposed off twice daily before each feeding. An adjustment was made every week based on the 5% body weight using the weight of the heaviest pig in the lot as the reference weight. The performance of the animals in terms of feed intake, weight gain, feed conversion ratio and efficiency of feed utilization was determined throughout the entire period. The costs per kilogramme of feed and meat were also calculated to determine the economic benefits of the treatments.

At the end of the eighth week, the animals were taken to the abattoir unit of the farm where they were starved overnight. Water was however provided *ad libitum* for the starved animals. The animals were thereafter slaughtered by stunning and exsanguination and the carcass parameters on each animal were taken.

Experimental diets

Two nearly isonitrogenous and isocaloric grower's pig diets were formulated with the feed ingredients shown in Table 1. Diet I contained 15% inclusion of PKC and is considered as the reference diet while Diet II contained 15% inclusion of DPW which was formulated to totally replace the PKC in the reference diet. The proximate composition of the experimental diets and D.P.W. was also determined and was as shown an Table 2

Data collection

The performance of the animals in terms of feed intake, weight gain, feed conversion ratio and efficiency of feed utilization was determined through out the entire period. At the end of the eighth week, all the animals were taken to abbatoir unit of the section, starved overnight and slaughtered through stunning and exsanguination. Hairs were removed from the carcass by scalding the skin with hot water followed by rapid shaving with special knives designed for such purposes. Carcass parameters in terms of eviscerated or dressed weight, dressing percentage and percenttage loss from the weight of inedible offals and gut content were determined.

Chemical analysis

Proximate analyses of the treatment diets and DPW were determined using the procedure of AOAC (1995). The gross energies of the feed and DPW were analyzed using Gallenkamp oxygen ballistic calorimeter.

Economic analysis

The costs per kilogramme of feed and meat were calculated to compare the economic benefits of the treatment diets.

Table 2. Proximate composition of experimental diets and Dried Poultry waste (% dry matter basis).

Nutrients	Treatment I	Treatment II	D.P.W.
Dry matter	89.75	90.05	89.28
Crude protein	16.73	16.93	21.67
Crude fibre	9.69	13.31	11.59
Ether extracts	5.64	3.74	2.41
Ash	5.23	10.03	23.83
Nitrogen free extract	62.71	55.97	40.50
Gross Energy (kcal/g)	4.12	4.27	3.85

Table 3. Weight gain, Feed Conversion Efficiency and Efficiency of Feed Utilization for the period 0-8 weeks

(a)	Weight gain		
	WK	T_1	T_2
	1	14.3±0.25	13.4±0.18
	2	14.1±0.21	13.6±0.54
	3	17.3±0.17	14.9±0.11
	4	16.0±0.35	14.6±0.07
	5	17.4±0.29	16.0±0.16
	6	16.2±0.24	16.9±0.11
	7	18.8±0.00	14.6±0.12
	8	22.0±0.12	18.9±0.33
(b)	**Feed Conversion Ratio**		
	WK	T_1	T_2
	1	2.56±0.16	2.73±0.15
	2	3.01±0.18	3.41±0.73
	3	2.60±0.11	3.01±0.08
	4	3.37±0.26	3.65±0.07
	5	3.26±0.25	3.51±0.13
	6	4.01±0.24	3.82±0.01
	7	3.72±0.00	4.81±0.16
	8	3.44±0.08	4.05±0.31
(c)	**Feed Efficiency Ratio**		
	WK	T_1	T_2
	1	0.39±0.03	0.39±0.02
	2	0.34±0.02	0.32±0.05
	3	0.39±0.01	0.33±0.01
	4	0.30±0.03	0.28±0.01
	5	0.32±0.02	0.29±0.01
	6	0.25±0.02	0.26±0.01
	7	0.27±o.00	0.21±0.01
	8	0.21±0.01	0.25±0.01

Statistical analyses

All the Data obtained were subjected to statistical analyses using the cross sectional design of the two-sample t-Test for independent samples with equal and unequal variances (Rosner, 2000) while using PC-SAS T-test Programme (PROGT-Test) computer package to carry out the analyses. Equality of variances was verified using the F-test and significant level determined by two-sample t-Test as described by Snedecor and Cochran (1973).

RESULTS AND DISCUSSION

Performance characteristics

Table 4 shows the performance characteristics of pigs fed the two treatment diets for the entire period of the study. The PKC diet has a significantly better final weight and weight gain ($P<0.05$) than the DPW diets despite having a slightly poorer initial weights. The proximate composition of the feed and DPW showed a high level of crude fibre in the DPW diet and also in the poultry waste itself when compared with the PKC diet. This higher crude fibre component might have accounted for the decreased weight gain of pigs fed the DPW diet. This is consistent with the finding of Rohweder et al. (1978) that high indigestible components of diets reduced digestibility of other feed components. Both diets however gave poorer values for this class and age of pigs when compare with those obtained by Haydon et al. (1989). Daily gains were comparable to those given by Kerr and Easter (1995) which ranged between 576-688 g.

The feed conversion ratio was poorer on the DPW diets but did not show any significant statistical deference ($P>0.05$). The efficiency of feed utilization was better on PKC and showed a statistical significant difference ($P<0.05$) between the two treatment diets (Table 4). Figures 2 and 3 further helped to illustrate the relationship between the Feed Conversion Ratio (FCR) and Efficiency of Feed Utilization (EFU) over the eight-week period. The DPW diet gave poorer values for the parameter up to week six where it showed a better performance than the PKC diet. Also Figure I revealed a persistent better showing of PKC diet over DPW diet for most of the entire period.

The feed intake in the two treatments gave the same numerical value since the animals were feed on the basis of 5% of their body weight and daily feed intakes after the first period of adjustment were equal to feed offered with no feed left. The fact that the animals consumed all the feed given to them implied that the use of DPW at this

Table 4. Performance characteristics of pigs fed DPW as a replacement for PKC.

Parameters	PKC DIET	DPW DIET
Ave. ini wt in Kg	25.3 ± 0.25	25.35 ± 0.26
Ave. final wt in kg	59.50± 0.13	56.15± 0.24
Total feed intake in kg	442.40	442.40
Feed intake/pig in kg	110.60	110.00
Feed conversion ratio	3.23± 0.26	3.59± 0.05
Efficiency of feeed utilization	0.318[a]± 0.003	0.288[b]± 0.005
Daily weight gain/pig in kg	610.71[a]± 0.032	550.0[b]± 0.029
Wt gain /pig for the period of trial in kg	34.2[a]± 0.34	30.80[b]± 0.32
Mortality	-	-
Morbidity	-	-

a, b = means with different superscripts are statistically different (P<0.05)

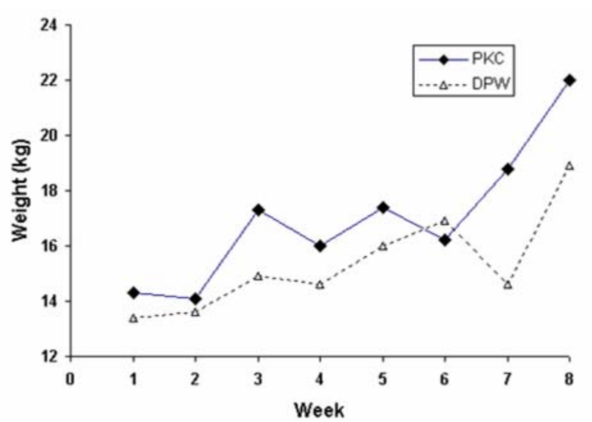

Figure 1. Weight gain of pigs fed PKC and DPW diets for the period 0 - 8 weeks.

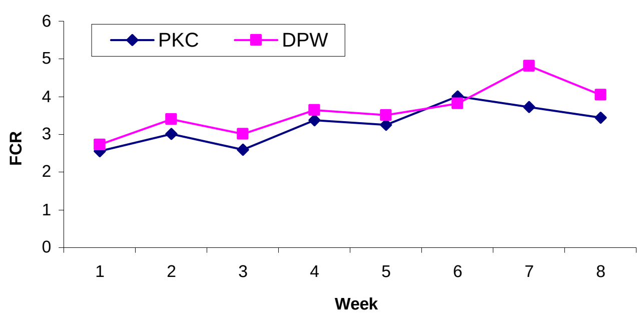

Figure 2. Feed conversion ratio of pigs fed PKC and DPW diets for the period 0 - 8 weeks

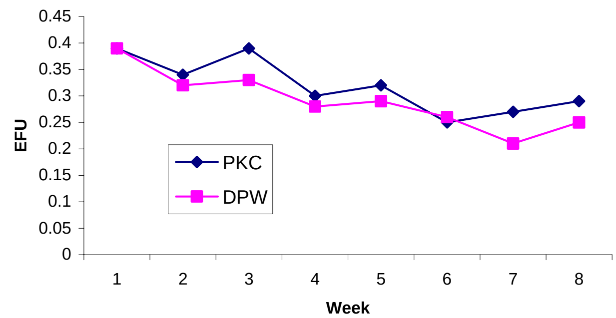

Figure 3. Efficiency of feed utilization of pigs fed PKC and DPW diets for the period 0 - 8 weeks

level (15%) in the diet did not compromise feed intake. In fact, Okagbare and Akinsoyinu (1998) reported that the inclusion of poultry waste up to 42% has no adverse effect on feed intake, nutrient utilization and health of growing goats and concluded that it agrees-with the 40% maximum level of inclusion of poultry waste recommended by Taiwo et al. (1995) in the ration of West African Dwarf Sheep. This especially gave credence to the use of DPW in livestock rations and helped to allay the fear of its health implications. These findings were corroborated by the work of Okagbere and Akinsoyinu (1998) who reported that D.P.W. could be used up to 42% without any adverse effect on the health of growing goats. No mortality was recorded in the two treatments and all animals remained in sound health with no observable manifestation of ailment throughout the trial period.

Carcass characteristics

The carcass characteristics considered under this study were those bearing direct relevance to the saleable cuts, which according to the economic philosophy of Songhai are to be accorded the highest priorities. These carcass characteristics were as shown in Table 6. The starved and dressed weights bore direct correlation to the live weights of the animals and showed statistical significant differences (P<0.05) due to the treatment effects. However, there were no significant difference (P>0.05) in dressing and loss percentages. The loss percentage in DPW diet was however slightly better than in the PKC diet.

Table 5. Estimated feed costs and monetary gains of Pigs fed D.P.W as a replacement for PKC.

Parameters	A	B
No of Pigs	4	4
Wt gain/ pig (kg)	34.2[a]±0.032	30.8[b]±0.029
Feed cost / Pig (₦)	3,904.73	3,603.90
Feed cost /kg of feed (₦)	35.30	32.58
Monetary value of gain/Treatment at N200/ kg of meat(₦)	27,780±11.75	24.640±57.16
Feed cost/ treatment (₦)	15,618	14,415.58
Monetary gains/ treatment (₦)	11,661.09	10, 224.42
Monetary gains/ Pig	2,915.27±122.2	2,556.11±61.86
Wt gain/ Pig for the period (kg)	34.2[a]± 0.34	30.8[b]± 0.32

A= The P.K.C. diet
B= The D.P.W. diet
[a,b] = means with different superscripts are statistically significant (P<0.05)
X ± SEM.

Table 6. Carcass parameters of pigs fed DPW as a replacement for PKC

Parameters	PKC DIET	DPW DIET
Slaughtere wt in kg	59.2[a]± 0.11	55.88[b]± 0.28
Dressed wt in kg	43.57[a] ± 0.20	41.39± 0.30
% dressed wt.	73.66 ± 0.38	74.08 ± 0.22
% dressing loss	26.07 ± 0.49	25.92 ± 0.22

a, b = means with different superscripts are statistically different (P<0.05)

The slaughtered and dressed weight reflected the two treatments and both are indicators of the poorer feed efficiency of the DPW diet. Pigs on DPW diets however had a better dressed weight percentage and hence better dressing loss percentage. In the opinion of Pond et al. (1989), one could therefore suggest that feeding DPW does not contribute to increase in visceral organ size at this age and therefore no possible diversion of nutrients meant for the growth of edible carcass to the visceral organ. The dressing percentage (74%) obtained by Jegede et al. (1994) in their study on boars fed on PKC diets is similar with values of 73.66 and 74.08% obtained in this study with PKC and DPW diets, respectively.

Economic indices

Table 5 shows the economic indicators of performance of the two dietary treatments. Total weight gain per treatment was significantly (P<0.05) better on the PKC diet than on the DPW diet. Also, the gain per treatment followed the same trend; ₦27,280 vs ₦24,640, respect-tively. The net benefit per animal calculated as monetary gain/animal minus feed cost/animal pointed to the PKC diet as a better indicator but with a statistically insignificant (P>0.05) difference.

The feed cost per treatment gave ₦15,618.91 vs ₦14,415.58 for the PKC and DPW diets, respectively. It should be noted here that the DPW was accorded the same cost value expended on the purchase of the PKC. The feed cost/kilogramme of feed was ₦35.30 vs ₦32.58 for the PKC and DPW diets, respectively, with a difference of almost ₦3.00/kilogramme of feed between them. The feed cost per animal also gave a value of ₦3,904.728 for the PKC diet as opposed to ₦3,603.985 obtained for the DPW diet. All these cost indicators were persistently higher for PKC diet than for the DPW diet. These economic indicators of performance of the two dietary treatments revealed that it is more economical to use DPW in the diets since the net benefit on the treatments in terms of monetary gains, though better on PKC were closely matched and did not show any significant statistical difference (P>0.05). Since barrows are designed to be fattened and if so conditioned to attain an average slaughter weight of 60 kg as obtained in this trial, the waiting period between the PKC and DPW diets is only six days and at that period about ₦3.50/day/pig would have been saved. Jegede et al. (1994) and Babatunde et al. (1975) advanced this line of cost benefits in favour of the utilization of PKC in ration formulation for pigs. Our own research work has now gone further to find a near perfect replacement for PKC in pigs' ration that would be more cost effective and would not compromise the health and performance of this class of livestock.

Conclusion

This trial revealed the nutritional potential that could be tapped through the use of DPW and we can therefore suggest that DPW did not in any way compromise feed intake at this level (15%) of inclusion in the diet. DPW replaced perfectly PKC in the practical diet in terms of energy and protein content, and it poses no health risks to the pigs. Furthermore, DPW is more cost effective than PKC and could therefore be recommended for the fattening-finishing operation as the farmers would enjoy more comfortable returns on their investment at a much reduced financial stress. Finally, DPW is a sustainable way of recycling waste thereby helping to solve the problem of waste disposal and environmental pollution within the farm setting and the society at large.

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