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EFFECTS OF AGRO-INDUSTRIAL WASTES ON THE PERFORMANCE OF EXOTIC COCKERELS

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Target Audience: Poultry farmers, livestock feed millers, poultry nutritionists, researchers in animal production and policy makers.

ABSTRACT

The effects of different agro-industrial wastes on the performance and nutrient retention of exotic cockerels (Barred Plymouth Rock) were studied during the early dry season of 1998. Five dietary treatments A,B,C,D and E made up of wheat offal, corn offal, millet waste, maize waste and cocoa pod husk, were formulated and supplemented with equal amounts of animal and plant proteins.

The various agro-industrial wastes significantly ($P < 0.05$) influenced average body weight gain, average feed intake, feed conversion ratio, feed efficiency ratio and total digestible nutrients of the experimental birds. The results indicated that the inclusion of various agro-industrial by-products in cockerel diets had direct effects on the birds nutrient digestibility and utilization. Fibre of various origin influenced the performance of cockerel finishers differently in terms of daily weight gain (-12.86 to 6.67g/bird) and feed intake (70.74 to 92.33g/bird). Wheat offal, millet waste and cocoa pod husk did not encourage weight gain of the cockerel finishers at 38.8 % inclusion level whereas corn offal and maize waste supported weight gain and gave the best values ($P<0.05$) for total nutrient digestibility (TDN). Despite the high fibre content of the experimental diets, no mortality was observed among the finisher cockerels.

Key Words: Exotic cockerels, agro-industrial wastes, performance.

DESCRIPTION OF PROBLEM

Costs of feed conversion by pigs and poultry are very high as a result of the increased costs of the ingredients required to formulate their concentrate feeds, hence the nutrient supply must be judiciously manipulated to ensure the production of meat and egg at moderate economic rates. Egbunike and Ikpi (1) highlighted the tremendous potentials of agro-industrial by-products which were at least 738,271.6 tonnes and crop residues of at least 52 million tonnes in Nigeria. Ogbonna (2) confirmed that production of agro-industrial waste is at least one million tonnes per annum in Nigeria. The potential value of agro-industrial by-products and their maximum inclusion rates in livestock diets depend on their nutritional characteristics, their safety for animal health

and the attractiveness to alternative uses (3) However, the use of agro-industrial by-products and crop residues has limitations. There is need to increase the production of cereals and grain legumes through genetic programmes and improved agronomic practises in Nigeria.

Cocoa husk meal (CHM) is a by-product derived from cocoa pod husk, through slicing or chopping and drying when in the fresh state (4). The authors put the quantity of cocoa pod husk which lays waste annually in Nigeria's cocoa farms at about one million tonnes on dry weight basis. Broilers, pullets, layers and pigs had been the subjects of so many CHM, Corn offal and wheat offal studies (5, 6, 7), while information is scarce on the finishing cockerels. Large quantities of millet and maize wastes are produced on daily basis within Ibadan Metropolis by small scale corn-pap producers.

Lower energy requirement of cockerels makes it possible for the use of some agro-industrial by-products as partial replacements for maize. Cockerels consume 21 and 16 % CP at starter and finisher phases, with corresponding 2.45 to 2.65 and 2.75Kcal/g ME, respectively (8). The author further recommended that cockerels should be finished on a lower energy of 2.25kcal/g ME and higher level of fibre inclusion in the diet. Cockerel production does not appear profitable when the conventional rations utilized by the other breeds of poultry are used for its production. This study was designed to investigate the effects of high levels of dietary fibre, using different agro-industrial wastes, in the diet for finishing cockerels

MATERIALS AND METHODS

The experiment was carried out at the University of Ibadan Teaching and Research Farm in the month of December, 1998. The duration of the experiment was three weeks. The average monthly ambient temperature and relative humidity during the month of experiment were 32.7°C and 62. 8 %, respectively.

Thirty exotic cockerels of 15 weeks of age, weighing averagely 1594g/bird were allocated to five dietary treatments with two replicates each. The birds were deloused once and dewormed thrice while all the five dietary treatments A, B, C, D and E were made of wheat offal , corn offal, millet waste, maize waste and cocoa pod husk, respectively as main sources of fibre (Table 1) . The diets were supplemented with equal amounts of animal and plant proteins. The experimental design employed was Randomised Complete Block Design (RCBD). Data obtained were subjected to analysis of variance (ANOVA) while Duncan's Multiple Range Test was used to assess significant differences (9)

The test ingredients were collected from commercial agro-industrialists and sun-dried for 4 days on polythene sheeets to a moisture content of 8 to 13.38%, but that of millet waste was about 5.0 %. After drying the test ingredients were milled, packed in polythene bags and stored at room temperature for two days before being used for the diet formulation. Cocoa pod huskmeal

was processed as described by Sobamiwa and Longe (5).

Thirty exotic cockerels were deloused once and dewormed thrice while all other medications were administered as at when due. The birds were managed on deep litter for fourteen weeks and thereafter transferred to cages at the fifteenth week. Fresh cool water and feeds were provided *ad libitum* and the required data collected accordingly. Proximate composition of the test ingredients, experimental diets and the faecal samples were determined by AOAC (10) method.

The digestibility study was done after two weeks of the commencement of the experiment. Four experimental birds per treatment (i.e two per replicate) were randomly selected and transferred to metabolic cages for three days adaptation period, followed by four days of total collection of faeces. Celophane sheets were layed under the cages for the collection of the droppings. The faeces were sun-dried , bulked and representative samples taken for analysis.

All data collected were subjected to analysis of variance while Duncan's Multiple Range Test (Steel and Torrie 1980) was used in assesing the significant difference.

Table 1. Gross composition of experimental diets

Ingredients %	Treatments				
	A	B	C	D	E
Maize	38.00	38.00	38.00	38.00	38.00
Wheat Offal	38.70	-	-	-	-
Corn Offal	-	38.70	-	-	-
Millet Waste	-	-	38.70	-	-
Maize Waste	-	-	-	38.70	-
Cocoa Pod Husk	-	-	-	-	38.70
Full Fat Soya	18.00	18.00	18.00	18.00	18.00
Fish Meal	1.50	1.50	1.50	1.50	1.50
Bone Meal	2.00	2.00	2.00	2.00	2.00
Oyster Shell	1.00	1.00	1.00	1.00	1.00
Methionine	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25
Vitamin-Mineral Premix*	0.25	0.25	0.25	0.25	0.25
	100	100	100	100	100
Calculated Analysis:					
Crude Protein (%)	11.97	9.64	10.80	9.02	
Crude Fibre (%)	11.18	5.51	5.51	6.08	5.90
Metabolizable Energy (Kcal/kg)	2127	2371	2085	1820	2123

*Agricare premix, Pfizer Product Plc, Ikeja, Lagos, contains the following vitamins, A, D_3, E, B_{12} and ribloflavin; pantothetic nicotinic and folic acids, choline chloride and selenium, P, Ca, I, Cu, Mn, Zn, Fe, Terramycin, anti-oxidant and anti-caking agent.

RESULTS AND DISCUSSION

Results of proximate composition of test ingredients and experimental diets as affected by the various agro-industrial wastes are shown in Tables 2 and 3, respectively. Least crude protein (CP) was contained in maize waste (1.76 %) and highest in millet waste (26.25 %) with corresponding crude fibre contents of 21.23 and 12.01 %, respectively. The proximate compositions of the test ingredients had direct effects on the nutrients composition of the experimental diets (Table 3). Results of proximate analysis of cocoa pod husk are similar to that reported by Oyenuga (11) and Sobamiwa and Longe (5). The values of proximate components of the wheat offal and millet waste agree generally with the reports of Bocque and Fiems (3) and Bath (12) while that of corn offal is in agreement with the reports Adesehinwa *et al.* (7) and Nwokoro (13). Proximate composition of the experimental diets A, B and E in terms of DM, NFE EE and CP agree with those reported for cockerel finishers (8,14). But the crude fibre values were rather high and do not agree with other published works (15) for poultry.

Table 2. Proximate compositon of test ingredients

Test Ingredients	Parameters, % (DM Basis)						
	M	DM	CP	CF	EE	Ash	NFE
Wheat Offal	8.38	91.62	15.58	9.89	5.02	5,96	55.1
Corn Offal	11.36	88.64	10.52	9.53	4.03	1.80	62.70
Millet Waste	3.63	96.37	26.25	12.01	6.99	2.60	48.5
Maize Waste	13.38	86.62	1.96	21.23	1.,76	13.21	48.4
Cocoa Pod Husk	11.74	88.26	17.68	20.12	6.32	7.86	36.2

Table 3. Determined Proximate Composition of experimental diets (DM Basis)

Parameters (%)	Experimental Diets				
	A	B	C	D	E
Moisture (M)	6.44	9.32	1.06	8.16	9.93
Dry Matter (DM)	93.56	90.68	98.94	91.84	90.07
Crude Protein (CP)	19.48	17.67	29.86	7.34	20.98
Crude Fibre (CF)	18.99	18.63	21.11	28.33	29.22
Ether Extract (EE)	4.01	3.91	4.21	3.48	4.14
Ash	9.62	5.98	6.60	15.21	12.68
Nitrogen Free Extract (NFE)	41.46	44.49	38.16	37.47	23.05

Results showed that significant (P<0.05) treatment effects were observed with averge daily feed intake, body weight gain, feed efficiency ratio and total digestible nutrients. Feed intake and weight gain were highest on the birds fed diets formulated with corn offal and maize waste and least on the birds fed diet formulated with cocoa pod husk (Table 4). The poor performance of the cockerels can be attributed to very high inclusion level (38. 7 %) of the fibrous test ingredients as against 20 % recommeded by Akinwande (16), Kratzer and Payne (17) and 30 % by Ogbonna (11) and 15 -20 % by Bath (12). Poor feed intake (70.74g/bird/day), growth rate (-12.86/bird/day) and poor utilization of cocoa pod husk based diet could be as a result of high lignin content of cocoa pod husk (18). Despite the high CP contents of wheat offal (15.58 %), millet waste (26.25 %) and cocoa pod husk (17. 68 %) , growth rates of the cockerels were negative, indicating amino acid imblance. But the maize waste based diet supported and encouraged weight gain, an indication of amino acid balance in the diets formulated with maize waste and corn offal. Hence diets with low caloric density encourage higher feed intake as was observed by Oluyemi and Roberts (19) and Hills and Dansky (20).

Table 4: Performance of Cockerels fed with experimental diets.

Parameters	Treatments					
	A	B	C	D	E	SEM
Average initial body weight (g/bird)	1570	1541	1520	1700	1641	2.94
Average Final Body Weight (g/bird)	1459.96^{a}	1631.09^{b}	1430.12^{a}	1840.07^{c}	1370.9^{a}	8.01
Average total weight gain/loss in 3 weeks (g/bird)	-110.04^{b}	90.09^{c}	-89.88^{b}	140.07^{d}	-270.06^{a}	6.48
Average Daily Weight gain/loss (g/bird)	-5.24^{b}	4.29^{c}	-4.28^{b}	6.67^{d}	-12.86^{a}	
Average Daily Feed Intake (g/bird)	81.98^{b}	92.30^{c}	76.75^{a}	92.33^{c}	70.74^{a}	9.35
Feed Efficiency Ratio	-0.06^{b}	0.05^{c}	-0.06^{b}	0.07^{c}	-0.18^{a}	0.10
Digestibility of the Nutrients/TDN (%)	28.32^{c}	22.01^{b}	23.46^{b}	13.85^{a}	28.77^{c}	6.65
Mortality	0.0	0.0	0.0	0.0	0.0	—

^{a,b,c,d} Mean with the same superscript on the same row do not differ significantly (P >0.05).

The total digestible nutrients (TDN) of the experimental birds ranged from 13.85 to 28.77 % as indicated in Tables 4 and 5. Lowest TDN (13.85 %) was recorded for birds in maize waste while the highest (28.77 %) was observed for birds on wheat offal cocoa pod husk. The diets had very high crude fibre (18.63, to 29.22 %) than that recommeded for cockerels production (4.5 to 8.0 %)

by Ogbonna *et al.* (14), hence very poor performance in terms of feed efficiency and total digestible nutrients (TDN). The least TDN (13.85 %) recorded on the birds fed maize waste was a reflection of its poor nutritive value.

Table 5. Apparent digestibility of experimental diets (nutrients retention) (%).

Nutrients	Treatments					
	A	B	C	D	E	SEM
Apparent Digestible Crude Protein	2.88[a]	3.59[a]	8.37[b]	3.00[a]	4.14[c]	0.34
Apparent Digestible Crude Fibre	5.38	5.66	6.62	8.5	7.41	1.24
Apparent Digestible Ether Extract	14.71[c]	3.08[b]	1.35[a]	1.23[a]	1.16[a]	0.26
Apparent Digestible Nitrogen Free Extract NFE)	5.35	9.68	7.12	1.12	16.04	0.69
Total Digestible /TDN	28.32[c]	22.01[b]	23.46[b]	13.85[d]	28.77[c]	6.65

[a,b,c,d] Mean with the same superscript on the same row do not differ significantly (P>0.05)

CONCLUSIONS AND APPLICATIONS

Results of apparent digestibility of nutrients revealed that increased dietary fibre had a direct effect on protein digestibility while the digestibility of other nutrients expressed as total digestible nutrients was very low (13.85 to 28.77 %). These results are in agreement with the work of Bickel and Deboer (21) who observed that increased dietary fibre resulted in increased secretion of faecal nitrogen, decreased digestibility of dietary protein and protein utilization in animals and human beings.

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