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GROWTH PERFORMANCE AND ECONOMY OF FEED CONVERSION OF BROILER CHICKENS FED DIETS CONTAINIING COWPEA MILLING WASTE AND PLANTAIN PEEL MEAL MIXTURE

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Abstract
144 day-old Arbor Acre chicks were used to investigate the effect of feeding diets containing cowpea milling waste and plantain peel meal mixture (CMWPPM) on the growth performance and economy of feed conversion of broiler chickens. The birds were randomly allotted to four dietary treatments in a completely randomized design model, and consisted of 0, 10, 20 and 30 % dietary inclusion levels of CMWPPM. Each treatment was replicated three times with 12 chicks per replicate, making a total of 36 chicks per treatment. The experiment lasted for eight weeks. Results showed that at the starter phase, birds on CMWPPM 0 % had significantly (P<0.05) higher feed intake, while birds on CMMPPM 20 % had significantly (P<0.05) lower feed intake than birds on the other treatments. The cost of feed and total cost of feed intake were significantly (P<0.05) higher for CMWPPM 30 % and significantly lower for CMWPPM 20 % than for the other treatments; while feed cost per kg weight gain had no significant difference across the treatments. At the finisher phase, there were no significant differences in all the growth performance parameters measured across the treatment groups. However, total cost of feed intake was significantly (P<0.05) higher for CMWPPM 10 % and significantly (P<0.05) lower for CMWPPM 20 %. The feed cost per kg weight gain was significantly (P<0.05) higher for CMWPPM 10 % and significantly (P<0.05) lower for CMWPPM 20 % and 30 % diets. Therefore, it is concluded that the inclusion level of CMWPPM in the diet of broiler chickens should not exceed 20 % for optimum economy of feed conversion at the starter phase; whereas birds can be fed diets containing 30 % dietary inclusion level of CMWPPM with good economy of feed conversion at the finisher phase.

Keywords: *Cowpea milling waste, plantain peel meal, growth performance, broiler chickens*.

Introduction

The poultry industry has not been a very lucrative enterprise because of high cost of conventional feedstuffs, which most times are competed for by both human beings and the livestock industry (Ironkwe and Oruwari, 2012). Nigeria, like many other developing countries of the world, is currently faced with shortage and high cost of conventional feedstuffs for poultry production (Duwa *et al*., 2014). This high cost and low availability of conventional poultry feedstuffs frequently demand consideration of by-products, even if efficiency of utilization is low, for poultry feeding (Negesse *et al*., 2009). It is important to utilize inexpensive materials not only to sustain the market of animal products but also to search for new sources of animal feed by recycling underutilized wastes (Ulloa *et al*., 2004). It is therefore necessary now for animal nutritionists to look for non-conventional feedstuffs that are readily available and cheaper in order to cut down on the feed cost, which constitute about 65-70 % of the total cost of production. Reports have shown that there are large numbers of feedstuffs with enormous potentials in Nigeria and one of such is plantain peel meal and cowpea milling waste.

Plantain peels are mostly regarded as wastes which constitute environmental pollution especially in urban areas where goats and sheep are not allowed to roam about (Ajasin *et al*., 2004; Ighodaro, 2012). Plantain peel is reported to have some nutritional values. It is a source of energy which compares favourably with maize, except for its crude fibre and ether extract content. Plantain peel is a good source of energy containing 12 % crude protein, 6 % crude fibre and 2700 Kcal/kg metabolizable energy on dry matter basis (Omole *et al*., 2008). It also contains higher levels of minerals such as calcium, iron and phosphorous (Nsa *et al*., 2010). Cowpea milling waste is a by-product obtained from cowpea. It contains 24 % crude protein and its nutrients can easily be utilized by livestock (Maidala and Bello, 2016). Research have shown that cowpea milling waste meal can be

fed to cockerel chicks up to 40 % inclusion level with no adverse effect on their growth performance (Raheem, 2016); while plantain peel meal can replace maize in broiler diets up to 75 % (Agubosi *et al*., 2019) or constitute as much as 50 % of a broiler diet (Nsa *et al,* .2010).
Although, cowpea (*Vigna unguiculata*) milling waste and plantain (*Musa paradisiaca*) peel meal have been used individually for feeding livestock, however, there are no reports on the use of cowpea milling waste and plantain peel mixture for feeding broiler chickens in Nigeria. Hence, this research study was designed to evaluate the growth performance and economy of feed conversion of broiler chickens fed diets containing cowpea milling waste and plantain peel meal mixture.

Materials and Methods

This research study was carried out at the Poultry Unit of the Department of Animal Production Teaching and Research Farm, Federal University of Technology, Minna, Niger State. This lies within the Guinea Savannah zone of Nigeria (latitude 9°37' North and longitude 6°33' East). Cowpea milling waste and plantain peel meal mixture were obtained from Kitchen Friendly, an agro–industrial company located in Gurara area of Minna. It was obtained as a by-product of cowpea and plantain processing, and used to compound four treatment diets as follows: T1 (without cowpea milling waste and plantain peel meal), T2 (with 10 % cowpea milling waste and plantain peel meal), T3 (with 20 % cowpea milling waste and plantain peel meal) and T4 (with 30 % cowpea milling waste and plantain peel meal) for the starter and finisher phases respectively (Tables 1). A total of one hundred and forty-four (144) day-old Arbor Acre broiler chicks were purchased from Damas Farm, Ibadan, Oyo State, Nigeria. Before the arrivals of the birds, the walls and floors of the pens were sanitized using Germicide (Izal®) solution, after thoroughly washing with detergent and water. The pens were then allowed to dry completely and litter materials made of wood shavings were spread on the floor of the pen. Newspapers were spread on the floor for the first one week of the experiment. Germ free feeders and drinkers were also made available with proper label of treatment and replicates for easy identification. Local pots and charcoal were made available during the brooding process to produce warmth for the chicks. The day old chicks upon arrival were made to acclimatize for one week after which the experimental diets were introduced to them. The birds were randomly allotted to four treatments in a completely randomized design (CRD) lay-out. Each of the treatment had three replicates made up of 12 birds per replicate. The experiment was carried out under an intensive management system with feed and water supplied *ad-libitum,* and it lasted for eight weeks. Vaccines were administered to the birds based on the recommendations of the Nigerian Institute of Animal Science (NIAS) for the region. Data were collected on feed intake, weekly weight gain and feed conversion ratio. Efficiency of feed conversion was determined based on the following parameters: feed cost per kg (₦), total cost of feed intake per bird (₦), and feed cost per kg body weight gain (₦/kg). Data collected were subjected to one-way analysis of variance using SPSS (2007) version 16.00. Where means were significantly different ($P<0.05$), they were separated using the Duncan Multiple Range Test as contained in the Package.

Table 1: Ingredient composition of the experimental diets at both the starter and finisher phases

Ingredient	Starter Phase				Finisher Phase			
	CMWPPM 0 %	CMWPPM 10 %	CMWPPM 20 %	CMWPPM 30 %	CMWPPM 0 %	CMWPPM 10 %	CMWPPM 20 %	CMWPPM 30 %
Maize	50.00	45.00	37.00	32.00	62.00	55.00	48.50	41.50
Maize offal	5.00	3.00	4.00	2.00	0.00	10.00	20.00	30.00
CMWPPM	0.00	10.00	20.00	30.00	20.50	17.50	14.00	11.00
Soyabean cake	26.00	23.00	20.00	17.00	10.00	10.00	10.00	10.00
Full fat soya	10.00	10.00	10.00	10.00	3.00	3.00	3.00	3.00
Fishmeal	3.00	3.00	3.00	3.00	1.00	1.00	1.00	1.00
Limestone	1.00	1.00	1.00	1.00	2.50	2.50	2.50	2.50
Bonemeal	3.50	3.50	3.50	3.50	0.25	0.25	0.25	0.25
Lysine	0.50	0.50	0.50	0.50	0.25	0.25	0.25	0.25
Methionine	0.50	0.50	0.50	0.50	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	100	100	100	100
TOTAL	100	100	100	100	62.00	55.00	48.50	41.50
CALCULATED ANALYSIS								
Crude protein (%)	23.17	23.01	23.10	23.02	19.84	19.94	19.87	20.01
ME (Kcal /kg)	2896	2883	2852	2839	2975	2962	2951	2930
Crude fibre (%)	4.45	4.75	5.35	5.64	3.80	3.78	3.72	3.68
Ether extract (%)	5.88	6.35	6.84	7.31	5.31	5.44	5.60	5.76
Calcium (%)	1.86	1.85	1.85	1.84	1.48	1.40	1.83	1.33
Available phosphorus (%)	0.78	0.79	0.78	0.78	0.74	0.78	0.77	0.78
Lysine (%)	1.20	1.21	1.40	1.46	1.25	1.28	1.30	1.33
Methionine (%)	1.15	1.15	1.10	1.07	0.60	0.60	0.61	0.62

*0.25kg of the premix contained: Vitamin A 1,000,00 IU, Vitamin D_3 200,000 IU, Vitamin E 2300 mg, Vitamin K_3 200.00 mg, Vitamin B_1 180 mg, Vitamin B_2 550 mg, Niacin 2,750 mg, Pantothenic acid 750 mg, Vitamin B_6, Vitamin B_{12} 1.5 mg, Folic acid 75 mg, Biotin 6mg, Choline chloride 30,000 mg, Cobalt 20 mg, Copper 300 mg, Iodine 100 mg, Iron 2000 mg, Manganese 4,000 mg, Selenium 20 mg, Zinc 3000 mg, Antioxidant 125 mg..

CMWPPM = Cowpea milling waste and plantain peel meal mixture ME = Metabolizable energy

Results and Discussion

The proximate composition of cowpea milling waste and plantain peel meal mixture (CMWPPM) is presented in Table 2. Dry matter, crude protein, ether extract, ash, crude fibre, and nitrogen free extract content were 83.40, 19.25, 9.50, 6.00, 9.00, 39.65 % respectively. This result shows that cowpea (*Vigna unguiculata*) milling waste and plantain (*Musa paradisiaca*) peel meal mixture has high crude protein and low crude fibre content, hence, the mixture can serve as a non-conventional protein feedstuff for broiler chicken.

Table 2: Proximate composition of cowpea milling waste and plantain peel meal mixture

Parameters (%)	Percentage composition (%)
Dry matter	83.40
Crude protein	19.25
Crude fibre	9.00
Ash	6.00
Ether extract	9.50
Nitrogen free extract	39.65

At the starter phase, birds on CMWPPM 0 % had significantly ($P<0.05$) higher feed intake, while birds on CMMPPM 20 % had significantly ($P<0.05$) lower feed intake than birds on the other treatments (Table 3). This result contradicts the findings of Abdon *et al* (2013) who reported that different dietary levels of cowpea seed had no significant ($P>0.05$) effect on feed intake in broiler chicken. The observed difference in feed intake in this study might be due to plantain peel meal inclusion in the diets which affected feed palatability and acceptability, and hence feed intake. There were no significant differences in all the growth performance parameters of the birds fed different dietary levels of CMWPPM at the finisher phase. This differs from the findings of Akanji *et al.* (2015) who reported that cowpea based diets had effect on broiler performance because feed consumed and growth response were extremely ($P<0.05$) declined in chicks fed unprocessed cowpea and dehulled cowpea diets respectively.

The results of the economy of feed conversion at the starter phase showed that as the level of cowpea milling waste and plantain peel meal mixture increased, cost of feed per kg decreased (which was not the case at the finisher phase). This is similar to the findings of Adama *et al.* (2007) when they fed sorghum dried brewers' grain to broiler chicken and reported that feed cost was significantly ($P<0.05$) lower when fed at 40 % dietary inclusion level. At the finisher phase, feed cost per kg weight gain was significantly ($P<0.05$) higher for CMWPPM 10 % and significantly ($P<0.05$) lower for CMWPPM 20 % and 30 % diets; whereas, there were no significant differences in feed cost per kg weight gain among the birds fed the different dietary treatments at the starter phase.

Conclusion and Recommendations

From the results of this research study, it is concluded that the inclusion of CMWPPM in the diets of broiler chickens should not exceed 20 % for optimum economy of feed conversion at the starter phase; whereas birds can be fed diets containing 30 % dietary inclusion level of CMWPPM with good economy of feed conversion at the finisher phase.

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Table 3: Growth performance and economy of feed conversion of broiler chickens fed diets containing cowpea milling waste and plantain peel meal mixture

Parameter	Starter Phase						Finisher Phase					
	CMWPP M 0 %	CMWPP M 10 %	CMWPP M 20 %	CMWPP M 30 %	SEM	P-VALUE	CMWPP M 0 %	CMWPP M 10 %	CMWPP M 20 %	CMWPP M 30 %	SEM	P-VALUE
GROWTH PERFORMANCE												
INI WT(g)	64.93	65.30	64.96	64.69	0.50	0.94	459.70	440.73	430.56	463.33	22.40	0.80
FIN WT(g)	459.70	440.73	430.56	463.33	17.40	0.80	1013.3	966.80	975.00	975.26	22.58	0.92
TFI(g)	1023.7^{a}	838.40^{b}	750.56^{c}	834.63^{b}	43.05	0.13	1524.03	1545.43	1205.76	1218.76	69.45	0.13
AFI(g)	36.56^{a}	29.94^{b}	26.80^{c}	29.81^{b}	1.53	0.13	54.42	55.18	43.06	43.52	2.48	0.13
TBWG(g)	394.76	375.43	365.60	398.66	17.30	0.84	553.63	526.06	544.43	511.93	28.77	0.89
ABWG(g)	14.10	13.40	13.05	19.69	1.30	0.24	19.77	18.78	19.44	18.28	1.67	0.89
FCR	2.60	2.25	2.05	1.67	0.15	0.22	2.82	2.94	2.24	2.38	0.14	0.30
MOR %	8.33^{b}	19.00^{a}	0.00^{c}	0.00^{c}	3.01	0.05	13.90^{a}	19.64^{a}	0.00^{b}	0.00^{b}	3.07	0.02
ECONOMY OF FEED CONVERSION												
COF (₦/kg)	181.45^{a}	151.45^{ab}	121.17^{c}	155.94^{ab}	8.44	0.06	254.58	262.79	208.05	213.95	11.30	0.18
TCOF intake (₦)	192.49^{a}	127.23^{b}	91.26^{c}	130.20^{b}	16.00	0.15	330.48^{ab}	409.24^{a}	251.06^{c}	260.76^{c}	24.05	0.037
COF/kgWG (₦)	493.55	343.81	248.80	334.14	42.60	0.25	616.04^{ab}	775.36^{a}	468.62^{c}	510.80^{c}	46.44	0.057

^{abc}Means in the same row with different superscripts were significantly ($p<0.05$) different.

CMWPPM = Cowpea milling waste and plantain peel meal mixture SEM = Standard error of mean

P-value = Probability value

INI WT = Initial body weight FIN WT = Final body weight

TFI = Total feed intake AFI = Average feed intake

TBWG = Total body weight gain ABWG = Average body weight gain FCR = Feed conversion ratio

MOR % = Percentage mortality

COF = Cost of feed TCOF = Total cost of feed intake

COF/kgWG = Cost of feed per kg weight gain