Performance of Broilers Fed Diets with Graded Levels of Cassava Waste Meal (CWM) as Energy Source

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ABSTRACT
Two hundred (200) day-old Anak broilers were randomly allotted to four dietary treatments; 1, 2, 3 and 4. Cassava waste meal (CWM) was used as energy source to replace maize at 0, 33, 66 and 100%, respectively in the starter and finisher phases which lasted for four and five weeks, respectively. Live weight, average weekly feed intake, weight gain and feed conversion ratio were significantly influenced (P<0.05) by dietary treatments in both phases. Birds on 33% cassava waste meal were significantly better (P<0.05) than those on other diets. The weights of organs of birds on 100% cassava waste meal were significantly (P<0.05) lower than others. Although cost of control diet was highest while that of 100% cassava waste meal was least, feed per unit gain was highest for the birds on 100% cassava waste meal. Results suggest that 33% replacement level of maize with cassava waste meal appears to be the optimum substitution level of cassava waste meal for maize in broiler production.
Key Words: *Performance, Broiler, Maize, Cassava waste meal, Energy source.*

INTRODUCTION

Feed cost is often implicated in the high cost of poultry products. It is estimated to represent over 70% of the total cost of producing poultry intensively (Oluyemi, 1984; Ogunfowora, 1984). The energy part of the finished feed represents the largest single dietary requirement of animals in terms of the cost due to the amount required (Olomu, 1995).

Cereals, which constitute a major source of energy, are currently expensive. Brown and Kane (1994) reported a world shortage of cereal grains arising from competing needs for the human population and diminishing food production capacity. High cost of cereals and uncertainty about their sustainable supply as energy source for livestock led to the search for alternatives.

Cassava (*Manihot esculenta* Crantz) is a high yielding starchy root crop from the tropics (Essers *et al.*, 1994). It is an important traditional dietary staple food of millions of people in sub-Saharan Africa and some other parts of the tropics (Iyayi and Yahaya, 1999). The highly metabolizable energy of cassava root meal (3870kcal/kg) (Tion and Adeka, 2000) and its' wide acceptability in the tropics makes it a possible alternative to cereals.

The surge to harness the potentials of cassava in livestock rations has brought about several investigations. These have revolved around cassava flour (Tewe and Egbunike, 1992), fresh tubers on cows (Okeke and Oti, 1998), root meal as replacement for maize in broiler rations (Eruvbetine, 1992) and cassava peel clones (Tewe *et al.*, 1999). However, information on effects of inclusion of cassava waste meal in broiler rations is scarce. Cassava waste consists of rinds, pulp and tuber by-products of cassava processing industry (Belewu and Musa, 2003). There exists an abundance of cassava waste from cassava processing units all over Nigeria (Iyayi *et al.*, 2002). This study therefore investigated the effects of replacing maize with cassava waste meal on the growth performance and gross morphology of Anak broiler birds.

MATERIALS AND METHOD

Two hundred (200) day old (Anak 2000) broiler chicks were raised at the poultry unit of the University of Calabar Teaching and Research Farm. The birds were randomly assigned to four treatment diets with two replicates each in a completely randomized block design. Each replicate had 25 birds. They were raised on deep litter for 9 weeks. The birds were fed with starter mash for 4 weeks and finisher mash for 5 weeks. The treatment diets consisted of diet 1 (control) having 36% maize without cassava waste meal. In diets 2 and 3, maize was replaced with cassava waste at 33% and 66% respectively, while in diet 4, cassava waste (100%) replaced all the maize (Table 1). Feed was given twice daily (morning and afternoon) and water supplied *ad libitum* over the 9-week period. Standard routine vaccination and medications were administered.

The chicks were individually weighed at day old and subsequently on a weekly basis up to 9 weeks of age. At the end of the 9 weeks, five birds per replicate were randomly selected and weighed to obtain the terminal live weight before slaughter. Thereafter, each of the selected birds was killed by slashing the throat and manually defeathered after scalding in water. Carcass and organs were thereafter weighed. All data were subjected to analysis of variance (ANOVA) means were separated using least significant difference (LSD) where significant differences were indicated (Steel and Torrie, 1980).

RESULTS

The average daily feed intake, weight gain and feed conversion ratio which ranged from 52.16 ± 10.71 to 54.63 ± 10.91g, 11.29 ± 1.39 to 15.28 ± 2.38g and 3.97 to 4.84 respectively in the starter phase and 133.67 ± 6.03 to 137.93 ± 7.06, 32.86 ± 7.59 to 35.18 ± 6.44 and 3.80 to 4.20, respectively in the finisher phase were significantly ($P < 0.05$) influenced by treatment diets (table 2). Birds on control and on 100% cassava waste meal diets had significantly higher ($P < 0.05$) feed intake and feed conversion ratio than birds on 33% and 66% replacement in both starter and finisher phases. However, weight gain for birds on diet 2 (33% cassava waste meal) was significantly higher than others.

The results of economics of productions are shown in table 3. Cost of feed per kilogram in the starter phase ranged from ₦19.21 (100% cassava waste meal) to ₦ 24.93 (0% cassava waste meal, Control). In the same vein, cost of feed in the finisher phase ranged from ₦19.24 (100% cassava waste meal) to ₦ 24.92 (Control). The feed per unit gain ranged from 3.41 to 4.84g for starter and 3.80 to 4.20g in the starter and finisher phases respectively (33% and 100% cassava waste meal inclusions).

Table 1: Composition of the experimental diets (DM Basis) with graded inclusion levels of cassava waste meal

Ingredients	Experimental Diets							
	Starter Phase				Finisher Phase			
	% Composition				% Composition			
	0	33	66	100	0	33	66	100
Maize	36	24	12	0	45	30	15	0
Cassava Sifting	0	12	24	36	0	15	30	45
Whole Soyabean (roasted)	38	42	44	44	30	32	34	36
Crayfish dust	6.0	8.0	10.0	10.0	4.0	5.0	6.0	7.0
Wheat offal	14.0	7.0	2.0	1.0	16.0	12.0	8.0	4.0
Bone meal	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Palm oil	3.0	4.0	5.0	6.0	2.0	3.0	4.0	5.0
Vit premix	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100	100	100	100
Calculated Analysis								
Crude prt(%)	24.9	25.0	24.7	24.7	21.15	20.42	20.0	19.0
Metabolizable Energy ($kcalkg^{-1}$)	3265.52	3343.68	3381.84		3172.10	3168.6	3362.75	3161.0

Vitamin premix (Hpra) contained per kg: 10,000,000 IU vit. A, 2,000,000 IU vit D_3, 0.75g vit B_1, 5,0g vit B_2, 25g Nicotinic acid, 12.5g calcium pantothenate, 0.015g vit B_{12}, 2.5g vit K_3, 25g vit E, 0.05g Biotin, 1g Folic acid and 250g chlorine chloride.

In the starter phase, unit cost per gain was least for diet 2 but highest for control, (diet I). Similarly, feed per gain was least for diet 2 but highest in birds on diet 4. However, in the finisher phase, diet 3 was lowest in cost per unit gain while diet 2 was least in feed gain.

Table 2: Performance of Birds on Diets containing graded levels of cassava waste meal

Parameters	DIETS			
Starter Phase	**1**	**2**	**3**	**4**
Daily feed intake/(g /bird)	54.45 ±10.79^{c}	52.16 ±10.71^{b}	52.98 ±10.65^{b}	382.38^{c} ±76.34
Daily wt gain (g/bird)	13.63 ± 2.73^{b}	15.28 ± 2.38^{c}	13.19 ± 2.71^{b}	11.29 ±1.39^{c}
Feed conversion ratio	3.97^{b}	3.41^{c}	4.02^{b}	4.84^{a}
Finisher Phase	**1**	**2**	**3**	**4**
Daily feed Intake (g/bird)	136.65 ± 7.55^{a}	133.67 ±6.03^{b}	134.27 +5.89^{b}	137.93+7.06^{a}
Daily wt gain (g/bird)	33.30± 7.26^{c}	35.18± 6.44^{c}	34.25 +6. 48^{bc}	32.86±7.59^{a}
Feed conversion Ratio	4.10^{a}	3.80^{b}	3.93^{b}	4.20^{a}

Means with identical superscripts on the same row are not significant (P>0.05)

Table 3: Production cost analysis of birds fed diets containing graded levels of cassava waste meal

Parameters	Diets							
	Starter phase				Finisher phase			
Parameters	1	2	3	4	1	2	3	4
Daily feed intake (g/bird)	54.45±10.79^{a}	52.16±10.71^{b}	52.98±10.65^{b}	54.63±10.91^{a}	133.65±7.55^{a}	133.67±6.03^{b}	134.27±5.89^{b}	137.93±7.06^{a}
Daily wt gain (g/bird)	13.63±2.73^{b}	15.28±2.38^{a}	13.19±2.71^{b}	11.29±1.39^{c}	33.30±7.26^{c}	35.18±6.44^{a}	34.25±6.48^{bc}	32.86±7.59^{c}
Avg total feed Intake (kg/bird)	1.52	1.46	1.48	1.53	4.78	4.68	4.70	4.83
Feed conversion ratio	3.97^{b}	3.41^{c}	4.021^{b}	4.84^{a}	4.10^{a}	3.80^{b}	3.93^{b}	4.20^{a}
Cost of feed (₦/kg)	24.93	22.23	20.66	19.21	24.92	22.35	20.52	19.24
Total cost of feed Consumed (₦/bird)	37.89	32.46	30.58	29.39	119.12	104.60	96.44	92.49
Cost of feed/unit Gain (₦/ kg)	98.97	75.80	83.05	92.98	102.17	84.93	80.64	80.81

Means with identical superscripts on the same row are not significant (P>0.05)

The mean body and organ weights of broilers are presented in table 4. The live weight, dressed carcass weight and some organ weights did significantly differ. However, there appears to be a decrease in live weight and dressed carcass weight as levels of cassava in the diet increased. Similarly, intestinal, kidney and gizzard weight were observed to decrease as cassava increased.

DISCUSSION

The average daily feed intake and weight gain, which ranged from 52.16±10.71 to 54.63±10.91g and 11.29±1.39g to 15.28 ± 2.38g, respectively in the starter phase, are similar to those of lyayi and Yahaya (1999), Onibi *et al* (1999) and 133.67±6.03 to 137.93 ± 7.06g and 22.86± 7.59 to 35.18± 6.44g, respectively in the finisher phase, but different from those of Nworgu and Egbunike (1999). Based on production cost analyses, diets 2 and 3 gave least cost per unit gain at starter (₦75.80/kg) and at finisher (₦ 80.64/kg) phases, respectively. The values are higher than findings of Nworgu and Egbunike (1999). Furthermore, in terms of feed quantity required per unit of gain, less of diet 2 in both starter (3.41g) and finisher (3.80g) was required per unit of chicken produced. The live weight gains in this study were significantly decreased ($P< 0.05$) with increasing levels of cassava waste meal, suggesting the presence of some anti-nutritional factors in the cassava.

Table 4: Carcass Characteristics of Broilers fed diets containing graded levels of cassava waste meal

Parameters	DIETS			
	1	2	3	4
Live weight (g/bird)	1461.25±1245[a]	1475.5±122[a]	1433.4±159[a]	1220.4±53.7[b]
Dressed carcass weight (g/bird)	1333.25±55.5[a]	1343.33±98[a]	1255.3 ± 169[b]	1110.1±46[c]
Eviscerated weight (g/bird)	1222.43±80[a]	1028±85[b]	1107.83±137[b]	838.03±29[c]
Intestinal weight (g/bird)	49.23±1.08[c]	44.6±6.7[bc]	40.25±3.5	38.7±3.9
Heart weight (g/bird)	7.95±0.68[a]	6.7±0.27[b]	8.1 ±0.56[a]	5.7±0.5[c]
Kidney weight (g/bird)	0.48±0.18	0.2±0.08	0.2±0.04	0.18±0.03
Gizzard weight (g/bird)	44.0±5.7[c]	33.98±2.9[b]	33.90±2.9[b]	27.73±3.2[c]
Liver weight (g/bird)	45.15±4.3[a]	35.1±3.0[b]	41.25±2.2[a]	32.5±2.6[b]
Crop weight (g/bird)	1.77±0.68	1.3±0.2	1.55±0.21	1.25±0.9

Means with identical superscripts on the same row are not significant ($P>0.05$)

Ogbonna and Ige (2002) also observed decreased liveweight with increase in levels of cassava leaf meal. Tewe (1981) had reported that inclusion of peel meal beyond 30% may present negative effects. Cassava contains cyanogenic glucosides nearly all in the form of linamarin (Essers et al 1994). It appears, therefore, that the anti-nutrient may be responsible for lower utilization of the nutrients and in turn decreased liveweight gain. Birds on diets having 100% cassava waste meal performed poorly. Similarly, the kidney weight and intestinal weights decreased ($P<0.05$) as dietary cassava waste increased. These results confirm earlier report by Shurlork and Forbes (1981) and Iyayi and Yahaya (1999), which indicated a relationship between liveweight, dressed weight, carcass part and organ weights. According to Iyayi and Yahaya (1999), any factor that enhances feed intake and growth rate will also influence these parts positively. In addition to the probable negative effects of anti-nutrients, the poor performance of birds on diet with 100% cassava waste could also be a result of the poor amino acid profiles of the diet (Mezoui, 1984). In this study, replacement of maize with 33% cassava gave best performance, but did not differ significantly from control and 66% replacement. However, animals placed on diet 4 having 100% cassava waste meal were significantly lower in gross morphology.

CONCLUSION

The results in the study indicate that replacing 33% maize with cassava waste meal in both starter and finisher phases of broiler production supported best weight gain with significant savings in production cost. Higher levels than 33% replacement of maize decreased performance.

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