Performance and economic benefits of meat-type chickens fed diets containing white and yellow cassava supplemented with different additives

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INTRODUCTION

- The scarcity and high cost of conventional feed ingredients such as maize has increased considerably due to competition with human food industry (Damisa, 2008).

- This has accelerated the demand to find alternative least-cost feed resources that can partially or fully replace these products in poultry diets (Eruvbetine *et al.*, 2003) and such example is Cassava.

- Cassava is the highest supplier of carbohydrates among staple crops and can potentially replace maize as an energy source in poultry diets without adverse effects on bird performance (Oyebimpe *et al.*, 2006).

INTRODUCTION CONTD.

- Fibrous content of cassava peel and the presence of cyanogenic glucosides which yield hydrocyanide (HCN) upon hydrolysis is a demerit (Banea-Mayambu *et al*., 1997; Udedibie *et al*., 2008).

- Cassava is also deficient in limiting amino acids and low in protein quality and quantity (Adeyemi *et al*., 2008; Olugbemi *et al*., 2010).

- The roots and products of white cassava variety are known to be deficient in β-carotene and other carotenoids (Khajarern and Khajarern, 2007).

- Deficiency of carotenoids could lead to *in vivo* oxidative stress with the attendant effects on animal products (Ngiki *et al*., 2014).

JUSTIFICATION

- Previous studies exist on the practical inclusion of whole cassava root meal as energy feedstuff in feed for poultry (Aderemi *et al.*, 2012; Oso *et al.*, 2013; Akapo *et al.*, 2014) but there is limited information on the use of biofortified (yellow) cassava in the feed of poultry.

- This study will therefore focus on the comparative utilization of unpeeled white and yellow cassava root meals (WCRM and YCRM respectively) supplemented with synthetic amino acids and appropriate exogenous enzyme by meat-type chickens.

MATERIALS AND METHODS

- *Experimental location*
- *Test ingredients (white and yellow cassava roots) and chemical composition (Table 1)*
- *Cassava processing*
- *Experimental diets (Tables 2 & 3)*
- *Experimental birds and management*

MATERIALS AND METHODS CONTD.

- Cassava root meals were analysed to determine their chemical constituents using the method described by Association of Official Analytical Chemists (AOAC, 1995).

- The fibre fractions were determined by the methods of VanSoest *et al*. (1991). Also, the cyanide content of the samples was determined per Bradbury *et al*. (1991). Some mineral elements like Ca, Ph, Cu, Mg, Mn and Zn as well as β-carotene of the cassava root meals were determined (AOAC,1997).

Table 1: Chemical composition of white and yellow cassava root meals

	WCRM	YCRM
Proximate Components (%)		
Moisture Content	9.58	8.67
Dry Matter Content	90.42	91.33
Crude Protein	2.20	3.56
Ether Extract	0.76	0.52
Crude Fiber	1.26	1.09
Ash	2.34	2.90
Nitrogen Free Extract (NFE)	83.77	82.98
β-Carotene (µg/100g)	15.42	349.01
Gross Energy (Kcal/kg) or MJ/kg	(3537.1) 14.80	(3457.1) 14.46
Hydrocyanide HCN (mg/kg)	26.60	25.40
Fiber Fractions (%)		
Nitrogen Detergent Fiber (NDF)	26.59	24.95
Acid Detergent Fiber (ADF)	15.58	14.06
Acid Detergent Lignin (ADL)	3.37	2.53
Hemicellulose	11.01	10.89
Cellulose	12.21	11.53
Mineral Content (mg/g)		
Ca	3.55	3.72
Ph	0.80	0.90

MATERIALS AND METHODS CONTD.

Dietary treatments

Diagram 1

Treatment 1	Treatment 2	Treatment 3	Treatment 4
WCRM Only (No Additive)	**WCRM + Amino Acids**	**WCRM + Enzyme**	**WCRM + Amino Acids + Enzyme**

Treatment 5	Treatment 6	Treatment 7	Treatment 8
YCRM Only (No Additive)	**YCRM + Amino Acids**	**YCRM + Enzyme**	**YCRM + Amino Acids + Enzyme**

Table 2: Gross composition of experimental diets fed to starting broilers

Ingredients	Diets							
	1	2	3	4	5	6	7	8
Maize	320	320	320	320	320	320	320	320
WCRM	136	136	136	136	-	-	-	-
YCRM	-	-	-	-	136	136	136	136
Soya Bean Meal	290	290	290	290	290	290	290	290
Fish Meal (70%)	10	10	10	10	10	10	10	10
Groundnut Cake	90	90	90	90	90	90	90	90
Wheat Offal	100	100	100	100	100	100	100	100
Palm Oil	10	10	10	10	10	10	10	10
Bone Meal	20	20	20	20	20	20	20	20
Oyster Shell	15	15	15	15	15	15	15	15
Methionine	2	2	2	2	2	2	2	2
Lysine	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Premix (Broilers)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Common Salt	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Additive (Amino Acid)	-	+	-	-	-	+	-	-
Additive (Enzyme)	-	-	+	-	-	-	+	-
Additive (Amino Acid + Enzyme)	-	-	-	+	-	-	-	+
TOTAL	1000	1000	1000	1000	1000	1000	1000	1000
Proximate Analysis								
Metabolized Energy (Kcal/kg)	2849.72	2849.72	2849.72	2849.72	2849.72	2849.72	2849.72	2849.72
Crude Protein (%)	22.80	22.80	22.80	22.80	22.80	22.80	22.80	22.80
Crude Fibre (%)	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84
Ether Extract (%)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

WCRM – White Cassava Root Meal; YCRM – Yellow Cassava Root Meal
*Synthetic Amino Acids – Methionine and Lysine
*Enzyme – Cellulase

Table 3: Gross composition of experimental diets fed to finishing broilers

Ingredients	Diets							
	1	2	3	4	5	6	7	8
Maize	378	378	378	378	378	378	378	378
WCRM	162	162	162	162	-	-	-	-
YCRM	-	-	-	-	162	162	162	162
Soya Bean Meal	204	204	204	204	204	204	204	204
Groundnut Cake	122	122	122	122	122	122	122	122
Wheat Offal	80	80	80	80	80	80	80	80
Palm Oil	20	20	20	20	20	20	20	20
Bone Meal	17	17	17	17	17	17	17	17
Oyster Shell	8	8	8	8	8	8	8	8
Methionine	2	2	2	2	2	2	2	2
Lysine	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Premix (Broilers)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Common Salt	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Additive (Amino Acid)	-	+	-	-	-	+	-	-
Additive (Enzyme)	-	-	+	-	-	-	+	-
Additive (Amino Acid + Enzyme)	-	-	-	+	-	-	-	+
TOTAL	1000	1000	1000	1000	1000	1000	1000	1000
Proximate Analysis								
Metabolized Energy (Kcal/kg)	3038.26	3038.26	3038.26	3038.26	3038.26	3038.26	3038.26	3038.26
Crude Protein (%)	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05
Crude Fibre (%)	5.74	5.74	5.74	5.74	5.74	5.74	5.74	5.74
Ether Extract (%)	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16

WCRM – White Cassava Root Meal; YCRM – Yellow Cassava Root Meal
*Synthetic Amino Acids – Methionine and Lysine
*Enzyme – Cellulase

MATERIALS AND METHODS CONTD.

- **Growth performance**

The body weight of birds in each replicate was weighed at the beginning of the experiment and weekly thereafter. Feed intake was calculated as the difference between the feed offered and left over. Weight gain and feed conversion ratio were then calculated.

- **Economic benefit**

The cost of feed ingredients at the time of study was noted and used to calculate the cost of feed per kg diet (₦/kg), total cost of feed consumed (₦) and cost of feed per weight gain (₦/kg)

- **Statistical analysis**

Data generated in 2 x 4 factorial was analyzed by analysis of variance technique using the SAS computer package (SAS Institute, 1999) to separate the main effects of using varieties of cassava. Interaction effect between the cassava varieties white or yellow and the type of additive (no additive, amino acid supplementation, exogenous enzyme or combination of amino acid and enzyme) was also determined. Differences between significant mean values was separated using the Duncan's multiple range test (Duncan, 1955).

RESULTS

Table 5: Effects of cassava varieties and use of additives on the performance of starting broilers (0-4 weeks)

Parameters	WCRM				YCRM				SEM
	None	A.A	Enzyme	A.A + Enz	None	A.A	Enzyme	A.A + Enz	
Initial live weight (g)	54.80	53.55	57.72	53.24	54.80	51.82	54.80	54.60	0.66
Final live weight (g)	658.48^{abc}	602.12^{c}	683.50^{ab}	616.36^{bc}	677.58^{ab}	709.09^{a}	670.61^{abc}	714.55^{a}	10.12
Weight Gain (g)	603.69^{abc}	548.57^{c}	625.78^{ab}	563.13^{bc}	622.78^{ab}	657.27^{a}	615.81^{ab}	659.94^{a}	9.83
Feed Intake (g/bird)	1302.73^{bc}	1405.15^{ab}	1463.47^{a}	1298.64^{bc}	1254.85^{c}	1271.21^{bc}	1456.67^{a}	1451.36^{a}	21.80
FCR	2.16^{cd}	2.56^{a}	2.34^{bc}	2.31^{bc}	2.02^{de}	1.93^{e}	2.36^{b}	2.21^{bc}	0.04
Cost of feed/kg diet (₦)	101.85^{d}	103.49^{c}	107.25^{b}	108.89^{a}	101.85^{d}	103.49^{c}	107.25^{b}	108.89^{a}	0.59
Cost of feed/kg weight gain (₦)	219.91^{c}	265.22^{a}	250.76^{ab}	251.13^{ab}	205.77^{cd}	200.15^{d}	253.58^{ab}	240.16^{b}	5.02
TCFC/bird (₦)	132.68^{bc}	145.42^{ab}	156.96^{a}	141.41^{bc}	127.81^{c}	131.56^{bc}	156.23^{a}	158.04^{a}	2.77

Table 5: Effects of cassava varieties and use of additives on the performance of finishing broilers (4- 8weeks)

	WCRM				YCRM				
Parameters	None	A.A	Enzyme	A.A + Enz	None	A.A	Enzyme	A.A + Enz	SEM
Initial live weight (g)	680.30	602.42	680.00	617.42	700.15	731.67	671.67	690.91	10.75
Final live weight (g)	1881.21	1900.61	1946.67	1883.94	1844.55	1858.48	1890.61	1896.97	14.67
Weight Gain (g)	1200.91	1298.18	1266.67	1266.52	1144.39	1126.82	1218.94	1206.06	19.26
Feed Intake (g/bird)	3195.64	3143.33	3232.33	3148.94	3239.61	3019.82	3102.33	3135.15	24.46
FCR	2.66^{ab}	2.43^{b}	2.56^{ab}	2.49^{b}	2.84^{a}	2.68^{ab}	2.56^{ab}	2.60^{ab}	0.03
Cost of feed/kg diet (₦)	91.57^{d}	93.21^{c}	96.97^{b}	98.61^{a}	91.57^{d}	93.21^{c}	96.97^{b}	98.61^{a}	0.59
Cost of feed/kg weight gain (₦)	243.87^{ab}	226.71^{b}	248.23^{ab}	245.51^{ab}	259.73^{a}	249.77^{ab}	248.67^{ab}	256.64^{a}	3.18
TCFC/bird (₦)	292.62^{ab}	292.99^{ab}	313.44^{a}	310.52^{a}	296.65^{ab}	281.48^{b}	300.83^{ab}	308.16^{a}	2.85

CONCLUSIONS AND RECOMMENDATION

- **CONCLUSION**
- Broiler performance was significantly influenced by cassava varieties and the use of additives.
- Supplementing both WCRM and YCRM with amino acids and enzyme singly or as a mixture improved feed intake at the starter phase.
- Amino acid supplementation of YCRM and WCRM improved growth performance at starting and finishing phases respectively.
- The most economic diet to yield a kilogram weight of broilers are diets containing YCRM supplemented with amino acids and WCRM supplemented with amino acids at starter and finishing phases respectively.

- **RECOMMENDATION**
- Broiler chickens can be fed 30% replacement of maize with either WCRM or YCRM in basal diet supplemented with amino acid for superior performance and economic benefits.
- **ACKNOWLEDGEMENT**
- The support of Cassava Adding Value for Africa (CAVA) project Phase II, Federal University of Agriculture Abeokuta, Nigeria towards the successful implementation of the project is quite appreciated.

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