EFFECT OF SUPPLEMENTAL METHIONINE OF PROCESSED CASSAVA ROOT (*Manihot esculenta,* CRANTZ) BASED DIETS ON GROWTH AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

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ABSTRACT
Cassava is increasing channeled into feeding livestock as energy source because of the high cost of maize. In a 6-week feeding trial, a total of 234 1-day-old broiler chicks of the Arbor Acres strain were randomly allotted to three dietary treatments (T1- Control (without cassava root inclusion and methionine supplementation), T2- Fermented cassava root and T3-Sundried cassava root) with or without methionine supplementation, with six replicate groups, in a completely randomized design. At 0 to 21 d, average daily feed intake (ADFI), average daily body weight gain (ADBWG) and Feed conversion ratio of birds were not significantly (P>0.05) affected. At 22 to 42 d, ADFI and Total feed intake (TFI) were not significantly (P>0.05) affected by dietary treatments, The daily body weight gain (DBWG) observed in T1 (55.16±3.62g) was significantly (P<0.05) higher compared to T2 (42.49±3.78) and T3 (42.24±3.31). A poorer FCR (P<0.05) was observed in birds on T2 (1.37±0.13) and T3 (1.36±0.11) compared to T1 (1.05±0.07). The DBWG observed in birds on T1 (76.62±3.61) was significantly (P>0.05) higher compared to T2 (65.36±3.46) and T3 (63.61±4.44). The overall body weight gain (BWG) was better (P<0.05) for birds fed fermented cassava root (1609.03g). The carcass yield did not (P>0.05) significantly vary along treatments. Breast meat was not (P>0.05) significantly affected by dietary treatments and values ranged from 19.98±0.86% (T3) to 20.35±1.41% (T2). Weight of drumstick (%) ranged from 10.08±0.96 (T1) to 10.70±0.59 (T3). The weights of wings (%), thigh, back, drumstick and neck were unaffected. Write your conclusion in one sentence.

Keywords: Cassava root, Methionine, Growth performance, Carcass characteristics, Chickens

INTRODUCTION

Cassava root is considered as an excellent replacement for maize though with attendant challenges of low protein, presence of cyanogenic glycosides and competition with humans (Tewe and Egbunike, 1988; Tewe, 2003). Incorporation of cassava into livestock diet is therefore hindered by presence of toxic cyanogenic glycosides, high fibre content, deficiencies of fatty acids, amino acids (especially methionine and tryptophan), vitamins, and minerals (Montagnac *et al.,* 2009). As such, cassava peels and roots should be processed rapidly following harvest to reduce cyanogenic potential and to preserve nutritive quality through drying, soaking, fermentation and/or combinations of these treatments. This study was aimed at investigating the effect of feeding sundried and fermented cassava roots in replacement for maize with additional supplemental methionine on broiler growth and carcass characteristics of broiler chickens.

MATERIALS AND METHODS

The research was carried out at the Poultry Unit, Teaching and Research Farm, University of Ibadan, Ibadan, Oyo State, Nigeria. A total of 234 of 1-day-old unsexed Arbor Acres broiler chicks were purchased from a reputable commercial hatchery in Ibadan, Oyo State, Nigeria, and were randomly allotted, on deep litter, to three treatments (T1-Control diet, T2-Fermented cassava product meal and T3-Sun-dried cassava product meal) with and without supplemental methionine in 6 replicate groups, in a completely randomized design. The chicks fed *ad-libitum* and appropriate vaccinations were carried out done.

Preparation of Fermented and Sun-dried Cassava Products

Fresh cassava roots were purchased from a local cassava and cassava product commodity market in Oyo East LGA, Oyo State, Nigeria. The cassava roots were divided into two batches, the first batch was peeled and soaked for 3 days and sun-dried until a moisture content of 10-12%. The second batch of the cassava roots were peeled, sliced into chips and sun dried and then milled. The two batches of cassava roots (Table 1) were incorporated in broiler diets (Table 2).

Data Collection and Statistical analysis

Feed intake was determined by giving a known quantity of feed to the birds and subtracting the leftovers for a given period from the quantity supplied. This difference was divided by the number of birds in a replicate group to estimate the feed intake per bird. Body weight gain of birds was determined by subtracting the initial weight for each week from the final weights with the aid of sensitive weighing scale. The feed conversion ratio was calculated by dividing the mean feed intake of birds by the mean body weight gain. Data were analyzed using descriptive statistics and analysis of variance (ANOVA) of SAS (2012) software package. Means were separated using Duncan`s Multiple Range Test of the above software package. All statements of significance were based on the probability level of 0.05. At the end of 6 weeks feeding trial, six birds, with weights were closest to the class mean weight, were slaughtered by slitting the jugular vein. The birds were then processed for carcass yield assessment in each replicate pen. Birds were weighed after slaughter, defeathered, eviscerated and cut into prima cuts. The respective carcass parts were then weighed and recorded and the values were expressed relative to the live weight of birds.

Table 1: Proximate Composition of Fermented Cassava and Sun-dried Cassava Root Meal

Components	Fermented cassava root	Sun-dried cassava root
Dry matter (%)	62.8	62.0
Crude protein (%)	3.50	1.70
Crude fibre (%)	1.90	3.40
Ether extractives (%)	1.50	1.70
Ash (%)	2.30	3.60
ME Kcal/g	4.30	2.92

Table 2: Gross Composition of Experimental diets at starter and finisher phases

	Starter phase			Finisher phase		
Ingredients	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
Maize	50.00	42.00	42.00	62.00	42.00	42.00
Fermented cassava root meal (FCRM)	-	10.00	-	-	10.00	-
Sun-dried cassava root meal (SDCRM)	-	-	10.00	-	-	10.00
Soybean meal	25.60	25.30	25.30	10.0	19.30	19.30
Full fat soybean	12.0	12.0	12.0	20.00	20.00	20.00
Wheat offal	3.50	3.50	3.50	2.00	2.00	2.00
Palm oil	2.50	2.50	2.50	2.00	2.00	2.00
Oyster shell	1.50	1.50	1.50	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
L-Lysine	0.20	0.20	0.20	0.20	0.20	0.20
DL-Methionine	0.20	0.50	0.50	0.20	0.50	0.50
Common salt	0.20	0.20	0.20	0.20	0.20	0.20
Vit-min Premix	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated nutrient composition						
Crude protein (%)	22.22	21.36	21.36	19.00	18.20	18.20
Crude fibre (%)	1.34	1.32	1.32	1.11	1.09	1.09
ME Kcal/g	3.03	2.99	2.99	3.19	3.15	3.15

RESULTS

The proximate composition of the sundried and fermented cassava roots is presented in Table 1. The composition of the starter and finisher diets are presented in Table 2. Summary of responses by birds or performance and carcass characteristics are shown on Table 3 and 4. At 0 to 21 d, average daily feed intake (ADFI) was not significantly (P>0.05) affected by dietary treatments. The average daily body weight gain (ADBWG) of birds at 0 to 21d did not differ significantly The FCR of broiler chicks fed fermented and sun-dried cassava ranged from 1.96 (T2) to 2.09 (T3). At 22 to 42 d, ADFI was not significantly (P>0.05) affected by dietary treatments, for 22-42 d the ADBWG observed in T1 (55.16g) was significantly (P<0.05) higher compared to T2 (42.49) and T3 (42.24). However better (P<0.05) FCR was observed in birds on T2 (1.37) and T3 (1.36) compared to T1 (1.05) at 22 to 42 d. At 0 to 42 d, ADFI values were not significantly (P>0.05) affected by dietary treatments. The BWG observed in birds on T2 (1609.03g) was significantly (P<0.05) higher compared to T1 (1372.47g) and T3 (1335.83g). Lower (P<0.05) FCR was observed in birds on T1 (1.33) compared to T2 (1.57) and T3 (1.60). It was observed that the live weight of birds on T1 (1634.00) was similar to T2 (1487.06) and was significantly (P<0.05) higher compared to T3 (1432.06g). The carcass characteristics are presented in table 4. Defeathered weight of birds was not significantly (P>0.05) affected by different dietary treatments and values ranged from 92.36 (T2) to 93.93 (T1). Birds had similar eviscerated weights and values ranged from 75.11 (T2) to 76.06 (T1). The back weight was unaffected (P>0.05) by dietary treatments and values ranged from 12.59 (T1) to 14.52% (T2). Breast meat was also not significantly (P>0.05) affected by dietary treatments and values ranged from 19.98 (T3) to 20.35 (T2). Weight of drumstick ranged from 10.08 (T1) to 10.70 (T3). The weights of wings were unaffected and values ranged from 8.06 (T1) to 8.49 (T2). The thigh and neck weights were not significantly affected by dietary treatments, and values ranged 9.68 (T3) to 10.03 (T2), 4.64 (T2) to 4.76 (T3), and 2.44 (T2) to 2.54 (T3).

Table 3: Performance of broiler chickens on diets supplemented with fermented and sundried cassava root meal

Phase	Parameters	T1	T2	T3	SEM	P-value
	ADFI (g/bird)	43.82	44.68	44.29	1.38	0.91
0-21 days	ADBWG (g/bird)	21.46	22.87	21.37	0.58	0.15
	FCR	2.04	1.96	2.09	0.09	0.64
	ADFI (g/bird)	57.56	57.71	57.34	0.16	0.36
22-42 days	ADBWG (g/bird)	42,49^{b}	55.16 ^{a}	42.24^{b}	1.44	<0.0001
	FCR	1.37^{a}	1.05^{b}	1.36^{a}	0.04	<0.0001
	TFI (g/bird)	2129.15	2150.15	2134.72	29.39	0.87
0-42 days	BWG (g/bird)	1372.47^{b}	1609.03^{a}	1335.83^{b}	33.11	<0.0001
	FCR	1.60^{a}	1.33^{b}	1.57^{a}	0.04	0.001

^{ab}Means of treatments along a row with different superscripts differed significantly (P<0.05). T1-Control, T2-Fermented cassava meal, T3-Sundried cassava meal, FI- Feed intake, TFI- Total Feed Intake, BWG-Body weight gain, ADFI- Average Daily Feed Intake, ADBWG- Average Daily Body Weight Gain, FCR-Feed conversion ratio, SEM-Standard error of means

Table 4: Relative Carcass characteristics (%) of Broiler Chickens Fed Fermented and Sun-dried Cassava Meal Based Diets

Ttm	LW(g)	DW	EW	Back	BM	DS	Wing	Thigh	Neck
T1	1634.00^{a}	93.93	77.44	12.59	20.08	10.08	8.06	9.79	4.74
T2	1487.06^{ab}	92.36	75.11	14.33	20.35	10.32	8.49	10.03	4.64
T3	1432.06^{b}	92.66	76.06	14.52	19.98	10.70	8.24	9.68	4.76
SEM	53.41	0.34	0.65	0.59	0.33	0.16	0.11	0.15	0.12
Pvalue	0.05	0.13	0.36	0.37	0.90	0.31	0.29	0.66	0.92

Ttm= Treatments ^{ab}Means of treatments along a row with different superscripts differed significantly (P<0.05). T1-Control, T2- Fermented cassava meal, T3-Sun-dried cassava meal, LW-Live weight, DW-Defeathered weight, EW- Eviscerated weight, BM- Breast meat, DS- Drumstick, SEM- Standard error of means.

At 0 to 21 d, average daily feed intake (ADFI) was not significantly (P>0.05) affected by dietary treatments. The average daily body weight gain of birds at 0 to 21d did not differ significantly The FCR of broiler chicks fed fermented and sun-dried cassava meal ranged from 1.96 (T2) to 2.09 (T3). At 22 to 42 d, ADFI was not significantly (P>0.05) affected by dietary treatments, The DBWG observed in T1 (55.16g) was significantly (P<0.05) higher compared to T2 (42.49) and T3 (42.24). Higher (P<0.05) FCR was observed in birds on T2 (1.37) and T3 (1.36) compared to T1 (1.05) at 22 to 42 d. At 0 to 42 d, ADFI values were not significantly (P>0.05) affected by dietary treatments. The DBWG observed in birds on T1 (76.62) was significantly (P<0.05) higher compared to T2 (65.36) and T3 (63.61). Lower (P<0.05) FCR was observed in birds on T1 (1.33) compared to T2 (1.57) and T3 (1.60).

DISCUSSION

Birds fed fermented cassava root-based diet had better performance in terms of final live weight gained. Fermentation of the cassava roots improved in value. Fermentation had been reported to lead to increase in protein and amino acid quality (Kitessa, 2024). Additionally, supplementation with methionine has been reported as an additive for protein synthesis and detoxification of cyanide (Adegbola, 1977). The results of present study partly agreed with the reports of Eruvbetine and Afolami (1992) who observed that the inclusion of cassava root meal up to 30% in diets for broilers had no detrimental effects on body weight. Adeyemi *et al.* (2008) reported lower feed intake in birds on cassava meal diets compared to control and attributed it to the adequacy of dietary energy.

CONCLUSION

Fermented cassava root-based diet with methionine supplementation improved the performance of broiler chickens. The efficiency of broiler chickens to effectively convert feed to gain was however reduced in diets with sundried cassava root-based diet and whole maize-based diet compared to the fermented cassava diet. Carcass yield of broiler chickens were higher on the control and fermented diets compared to sundried cassava root meal.

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REFERENCES

Adegbola, A.A. (1977). Methionine as an additive to cassava-based diets. Cassava as animal feed: *Proceedings of a workshop held at the University of Guelph*, 18-20 April 1977. Ottawa, IDRC. Pp 9-17.

Adeyemi, O.A., Eruvbetine, D., Oguntona, T., Dipeolu, M. and Agunbiade, J.A. (2008). Feeding broiler chicken with diets containing whole cassava root meal fermented with rumen filtrate. *Archivos de Zootecnia*, 57 (218): 247-258.

Adeyemi, O.A. and B.O. Sipe. (2004). *In vitro* improvement in the nutritional composition of whole cassava root-meal by rumen filtrate fermentation. *Indian Journal of Animal Science,* 74: 321-323.

Kitessa, D.A. (2024).Review on effect of fermentation on physicochemical properties, anti-nutritional factors and sensory properties of cereal-based fermented foods and beverages. *Ann Microbiol* **74**, 32 https://doi.org/10.1186/s13213-024-01763-w

Eruvbetine, D., Tajudeen, I.D., Adeosun, A.T. and Olojede, A.A. (2003). Cassava (*Manihot esculenta*) leaf and tuber concentrate in diets for broiler chickens. *Bioresource Technology,* 86:277–281.

Eruvbetine, D. and Afolami, C.A. (1992. Economic Evaluation of Cassava (Manihot esculenta) as a feed ingredient for broilers. *Proceedings for the XIX World's Poultry Conference*, RAI, International Exhibition and Congress Centre, Amsterdam. Pp.532-535.

Montagnac, J.A., Davis, C.R. and Tanumihardjo, S. A. (2009). Nutritional value of cassava for use as a staple foodand recent advances for improvement. *Comprehensive Reviews in Food Science and Food Safety* 8:181–194.

SAS (2012).Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.

Tewe, O. O. (2003). Economics of the commercial utilisation of local and alternative feed resources. Proceedings of the 30th Anniversary of the Annual Conference of the Nigerian Society for Animal Production (NSAP), Ibadan, Nigeria 16th -20th March 2003. Pp: 466-468.

Tewe, O. O. and Egbunike, G. N. (1988). Utilisation of cassava in non-ruminant livestock feeds. In: S. K. Hahn, L. Reynolds and G. N. Egbunike (eds). Cassava as livestock feed in Africa. Proceedings of the IITA/ILCA/University of Ibadan Workshop on the potential Utilisation of cassava as Livestock Feed in Africa. 14-18 November 1988. Ibadan, Nigeria.