ISSN 1427-4410
J. Anim. Prod. Res. (2020) 32(2):42-48

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ngUrl:journals.napri.gov.ng

EVALUATION OF PERFORMANCE CHARACTERISTICS AND COST IMPLICATION OF BROILER STARTER FED VARYING LEVELS OF SUNDRIED CASSAVA STARCH EXTRACT PULP

***[1,2]Raji, M. O., [1]Adams, T. O., [1,2]Oloko, B. A., [2]Fasasi, M. O., [1]Adebayo., H. D., [1]Usman, A. B., [2]Oso, A. O. and [2]Bamgbose, A. M.**

**[1]Department of Animal Health and Production Technology, Faculty of Animal and Fisheries Technology, Oyo State College of Agriculture and Technology, P.M.B 10, Igboora.*

[2]College of Animal Nutrition, Faculty of Animal Science and Livestock Production, Federal University of Agriculture, PM.B.2240, Alabata Road, Abeokuta, Ogun State

**Corresponding Author: papat4u@gmail.com 07087089847 and 08052433781*

ABSTRACT

A feeding trial was conducted at Teaching and Research Farm, Oyo State College of Agriculture and Technology Igboora, Nigeria, to evaluate effect of feeding sun dried cassava starch pulp (SDCSEP) on performance characteristics and cost implication of broiler starter. Two hundred (200) day-old cobs 500 were randomly allocated to five treatments T1 (control, 0%), T2 (10%), T3 (20%), T4 (30%), and T5 (40%) each having 40 birds, replicated 4 terms with 10 birds per replicate in a completely randomized design (CRD). Performance attributes evaluated were feed intake, weight gain, and mortality while Feed Conversion Ratio (FCR) was calculated. Cost implication of feeding different levels of SDCSEP was also calculated and the experiment lasted for four weeks. Significant differences were observed on all the performance attributes evaluated except FCR. It was shown that SDCSEP is a potential source of energy While, cost implication was least when SDCSEP replaced maize. It was concluded that best performance characteristics of broilers could be obtained when SDCSEP partially replaced maize at 20% levels of inclusion. However, it could be recommended that 20% inclusion levels of SDCSEP can be incorporated in broiler diets.

Keywords: Performance characteristics, sun dried, cassava, broiler, cost implication and weight gain

INTRODUCTION

A serious competition exists between feed industry and other channels in the food chain (especially man) over conventional feed ingredients such as maize and Soybean. This has resulted in the high cost and scarcity of these conventional feedstuffs. Poultry feed producers are thus faced with the task of finding alternative feedstuffs that will not compromise quality. The search for such alternatives has exercised Animal Nutritionists in Nigeria for over a decade (Onyimonyi and Onukwufor, 2003; Oke*et al*., 2005; Onyimonyi and Okeke, 2005; Tuleun *et al*., 2005). Cassava has been used as an alternative energy source and its inclusion in diets for poultry has been extensively studied (Tewe and Egbunike 1992; Eruvbetine 1995). Nigeria, being the world's largest producer of cassava should be able to utilize its vast potential to provide enough of the tuber, not only for human consumption, but also for animal feed. In animal feed, it can be used as flour after being peeled or chipped with the peels and ground before use. Studies have shown that levels as high as 20% could be used in diets for layers (Tewe and Egbunike 1992) and 40% in broilers (Eruvbetine and Afolami, 1992) and 10% in replacement pullets (Eruvbetine *et al.*, 2002). Onyimonyi and Okeke

(2005) reported that 20 percent of the maize content of the diets of grower pigs can be replaced by cassava peel meal without any deleterious effect on the carcass, organ characteristics and no pathological effects was observed. Moreover, substitution of maize in poultry diets with cassava starch pulp has been explored in numerous studies over the past 3 decades (Garcia and Dale, 1999; Akinfala *et al.*, 2002). Some studies with broiler chickens have shown that performance declines progressively as the quantity of cassava starch is increased in the diet (Ojewola *et al.* 2006; Khempaka *et al.*, 2009). Although earlier studies suggested lower inclusion rates of 8–10% must be maintained, more recent studies with broilers suggest that a substantial proportion (as much as 50 to 75–80%; Olugbeme *et al.* 2010 and Kana *et al.* 2012) of energy ingredients can be replaced with cassava chips or flour with no decrease in production, provided diets are balanced with other nutrients, cyanide levels are <141 mg/kg, and diet is not overly dusty (Apata and Babalola 2012). Addition of palm oil (3%) and cocoa husk (1%) to cassava meal was shown to improve broiler diet texture and palatability (Kana *et al.* 2012).The greatest limitation to the use of cassava for livestock feeds is its content of cyanogenicglucosides, linamarin and lotaustralin. Toxicity of cassava is caused by hydrocyanic acid (HCN) which is liberated when the glucoside is hydrolyzed by the action of linamarase enzyme. The degree of toxicity depends upon the variety, ecological conditions for growth of the plant, the form of the product being fed and its processing technology (Coursey, 1973). Tewe and Iyayi (1989) reported that hydrocyanic content of sundried pulp and oven-dried pulp was 17.3-26.7ppm and 23.7-31.3ppm respectively. Where the HCN is below 100ppm, as in cassava flour or chips, cassava can be safely incorporated into rations (Delange and Ahluwalia, 1983). Therefore, this research was directed toward evaluation of performance characteristics and cost implication of broiler starter fed varying levels of sundried cassava starch extract pulp (SDCSEP).

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Poultry Unit, Teaching and Research Farm of Oyo State college of Agriculture and Technology Igbo-ora, Oyo State, Nigeria. The experiment site is in savannah forest zone of Latitude 7.43^{o}Nand Longitude 3.8^{o}E, with an elevation 140m above sea level .The average minimum temperature is about 21-50^{o}C and maximum temperature of 32.50^{o}C. The average humidity in the area is 58.0%. The double maximum rainfall is about 214.3mm in June and 165.2mm in September. (Sanusi, 2011)

Procurement of the test ingredient

The fresh cassava starch pulp was procured from Psaltry starch processing industry, along Iseyin-Maya road, Oyo State. It was sundried on polythene nylon for 5 days and then taken to the laboratory for laboratory assay.

Laboratory analysis

The chemical composition of sundried cassava starch extract pulp (SDCSEP) was determined in the laboratory by using A.O.A.C, (2010) method. The metabolizable energy was calculated as described by Mc Donald 1995 as followed (37 x CP) + (81.8 x CF) + (35.5xNFE). Nitrogen free extract (NFE) was calculated using the following formula; 100 – (CP – CF – Fat – Ash - MC). CP= Crude protein; CF= Crude fibre; NFE= Nitrogen free extract; MC= Moisture content.

Experimental diets

The birds were given commercial feed from day 1-8 before experimental diets. Thereafter, five diets were formulated having percentage crude protein that ranged between 20.70% - 22.15% with energy ranged between 2893.35ME kcal/kg – 2979.30ME

kcal/kg. Maize was the main energy source for the control diet while the other four dietary treatments 2, 3, 4 and 5, maize was substituted with sundried cassava starch extract pulp at 10%, 20%, 30% and 40% (nutrient to nutrient) respectively.

Experimental birds and management

The 200 birds were randomly allocated to five dietary treatments, 40 birds per treatment consisting of 4 replicates with 10 birds each in a completely randomized design (CRD). The birds were fed *ad-libitum.* The dietary treatment was at inclusion levels of 0%, 10%, 20%, 30%, and 40% inclusion rate and designated as T1, T2, T3, T4 and T5 respectively. Commercial broiler starter was used at first week to stabilized birds, thereafter, experimental diets were used.

Table 1: Percentage composition of broiler starter (2-4 weeks)

Ingredients (kg)	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)
Maize	51.00	45.90	40.80	35.70	30.60
SDCSP	0.00	5.10	10.20	15.30	20.40
Soybean meal	35.00	35.00	35.00	35.00	35.00
Maize bran	10.00	10.00	10.00	10.00	10.00
Limestone	1.00	1.00	1.00	1.00	1.00
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Premix (B)	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Bone meal	2.00	2.00	2.00	2.00	2.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Energy ME (kcal/kg)	2979.30	2933.09	2919.85	2906.60	2893.35
Crude protein (%)	22.15	21.70	21.37	21.03	20.70
Ether extract (%)	3.43	3.23	3.03	2.83	2.62
Crude fibre (%)	1.53	1.63	1.73	1.83	1.93
Calcium (%)	1.12	1.12	1.10	1.08	1.06
Phosphorus (%)	0.62	0.62	0.62	0.62	0.62
Ash (%)	0.59	0.67	0.61	0.54	0.48
Lysine (%)	1.38	1.33	1.32	1.31	1.29
Methionine (%)	0.63	0.55	0.54	0.53	0.52

SDCSEP: sundried cassava starch extract pulp

Data Collection

Data were collected daily on feed intake; records of body weight were taken weekly while records of mortalities were kept throughout the four week experimental period.

Final weight gain (FWG): FWG was calculated by subtracting total weight gain from initial weight gain.

Feed intake (FI): FI was determined by subtracting weight of left over feed from the feed given.

Body weight gain (BWG): BWG were weighed on weekly basis and the weight was calculated by subtracting weight of preceding week from current week

Feed conversion ratio (FCR) was calculated at the ratio of feed consumed to the weight gain:

FCR = feed intake (g)

Weight gain (g)

Mortality = Number of dead birds

Number of stock birds

Cost of 100kg of feed (#) = 100kg x cost of feed in (#/kg)

Cost of weight gain in (#/kg) = cost of feed (#/kg) x weight gain

Cost of feed/bird in (#/kg) = cost of feed (#/kg) x feed intake

Data analysis

Data were subjected to analysis of variance (8). Means were separated by using Duncan multiple range test of the same software.

RESULTS AND DISCUSSION

Result of the inclusion of sundried cassava starch extract pulp (SCSP) in the diet of broiler starter was shown on table 2. Both final and weight gain were significantly affected ($p<0.05$) but birds fed on T1, T2, T3 and T4 were statistically similar and had significantly higher body weight than T5. This is an indication that nutrient utilization was performed better when sundried cassava starch extract pulp was partially substituted with maize (T2, T3, and T4) than when fed with T1 and T5. This finding support the report of Egena and Aya., (2007) who opined significant ($p<0.05$) different when experimental diets were fed with broiler starter. The reduced weights gain observed from birds placed on the T5 (40% SCSP) diets could be attributed primarily to traces of anti-nutritional factors (ANF) that binding nutrients which could have been available for tissue development.

The values of feed intake observed in both control (T1) and test diets (T2, T3, T4 and T5) were statistically similar as showed on table 2. The similar values of intake observed for birds fed test diets (T1, T2, T3 and T4) with T1 is evidence that their combination encouraged feed intake with control. The high feed intake values observed for birds fed T4 and T5 was due to the fact that birds find the SCSP digestible.

Feed conversion ratio (FCR) did not differ significantly ($p>0.05$) at starter phase as shown on table 2. This is indication of the adequacy of nutrients in all the diets, which means diets were able to meet nutrient requirement of the broiler starter. FCR of this study is in line with Oladipo *et al.,* 2015 who reported non-significant effect when experimental birds fed on the experimental diets. The observed numerical values revealed that SCSP showed relatively higher weight gain and improved feed conversion ratio than the control diet at comparative levels. This is an indication that sundried had improved the overall feed utilization resulting to increase in weight gain except T5 (40% SCSP) by causing degradation of fiber and non-starch polysaccharide (NSP) components of the SCSP based diets into soluble metabolizable products (Aguihe *et al.,* 2015).

Mortalities showed significant ($p<0.05$) effect as shown on table 2. Highest mortality was observed from birds placed on 40% SCSP diet (41.67%) where the birds had significantly hypertrophied liver, heart and lungs. This was followed by 30% SCSP diet (35.42%), the 20% SDCSEP diet (33.34%), the 0% SDCSEP (31.00%) and the 10% diet (18.75%). Thus higher level of inclusion of SDCSEP resulted in higher mortality.

Table 2: Performance characteristics of broiler starter (2-4 weeks)

Parameters (g)	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	SEM
Initial weight	123.75^{b}	125.00^{a}	123.75^{b}	123.23^{c}	121.75^{d}	0.24
Final weight	560.00^{a}	650.00^{a}	700.00^{a}	675.00^{a}	525.00^{b}	18.35
Weight gain	436.25 ^{a}	525.00^{a}	576.25^{a}	551. 77 ^{a}	403.25^{b}	18.22
Feed intake	1557.78^{ab}	1347.26^{b}	1513.87^{ab}	1637.10^{a}	1636.24^{a}	37.72
F C R	3.57	2.57	2.63	2.97	4.08	0.32
Mortality (%)	31.00^{ab}	18.75^{b}	33.34^{ab}	35.42^{a}	41.67^{a}	5.89

^{a,b,c} Mean with different superscript along the same rows show significant differences (P<0.05)
SEM= Standard error of mean F C R= Feed conversion ratio

Table 3 shows data on cost implication observed in this experiment. Feed cost per kilogramme (kg) of feed were significant (P<0.05) influenced, the highest cost per kg was obtained on treatment T2 (#135.17) while the lowest cost of feed per kg was on T5 (# 125.10). Total feed intake per bird was significantly (P<0.05) differed with highest P<0.05 of 1637.10 on T4 while lowest P<0.05 of 1347.26 was obtained on T2, however, T4 and T5 were significant (p<0.05) similar. Total cost of feed intake follow similar pattern with total feed intake per birds. Total weight gain (TWG) were also significantly (p<0.05) affected, the highest TWG of birds was obtained on T3 with values of 576.25g while lowest value of 403.25g was obtained on T3. Cost of feed intake/weight gain was significantly (p<0.05) influenced by the experimental feed (SCSP), with highest value of 4.06 on T4 while T2 had least value of 2.57 but T2 and T3 had similar statistics values.

As shown on table 3, the dietary inclusion of sundried cassava starch extract pulp increased cost of producing one kilogramme of feed. The observation of this study is in disagreement with Ani *et al.,* 2013 who opined reduction in the feed cost per kg weight gain. Control diet had best total cost of feed intake than others but in term of cost of feed intake/weight gain, both T2 and T3 revealed best results when compare with others.

Table 3: Cost implication of feeding varying levels of sun dried cassava starch pulp on broiler starter (2-4 weeks)

Parameters	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	SEM
Cost of 1kg feed (g/#)	115.61^{c}	135.17^{a}	131.05^{b}	128.46^{c}	125.10^{d}	1.52
Total feed intake per birds(g)	1557.78^{b}	1347.26^{d}	1513.87^{c}	1637.10^{a}	1636.24^{a}	23.90
Total cost of feed intake #	180.09^{e}	182.11^{d}	198.40^{c}	210.30^{a}	204.80^{b}	2.86
Total weight gain (g)	560.00^{c}	600.00^{a}	576.25^{a}	551.7b	403.25^{c}	13.68
Cost of feed intake/weight gain (kg)	3.00^{b}	2.57^{c}	2.63^{c}	2.97^{b}	4.06^{a}	0.13

a,b,c,d, e – means with different superscript across given row differ significant (P<0.05)

CONCLUSION

It was shown that sun dried cassava starch pulp is a potential source of energy and has valuable nutrients that can be utilized in the diets of broilers, thus could replace maize in order to reduce competition for maize and make broiler production available round the year without fear for availability of conventional energy source (maize). Equally, the cost implication of the replacement is least when SDCSEP was partially replaced with maize. Conclusively, best result was obtained when SDCSEP was partially substituted maize.

RECOMMENDATION

Based on outcome of this study, 20% inclusion levels of sun dried cassava starch pulp can be incorporated in broiler starter to have huge profit.

REFERENCES

Adegbola, D. and Oke, B. (1977). Amino acid supplementation of mandioca meal in the chick diets. *Poultry Science* 48: 1949-1953.

Aguihe, P. C., Kehinde, A. S. and Iyayi, E. A. (2015). Effect of enzyme (Maxigrain) supplementation on performance characteristics and nutrient digestibility of growing Japanese quail (*Cortunixcortunix japonica*) fed diets containing yam peel meal. *Nigerian Journal of Animal Science*. 17 (1): 65-74.

Akinfala, G. (2012). The effects of non-starch polysaccharide enzyme addition and dietary energy restriction on performance and carcass quality of organic broiler chickens. *Journal of Applied Poultry Resources*. 16: 1-12.

A.O.A.C. (2010). Association of Official Analytical Chemists. Official Methods of Analysis Washington D.C.

Apata D. F. and Babalola, T. O. (2012). The use of cassava, sweet potato and cocoyam and their by-products by non-ruminants. *International Journal of Food Science and Nutrition* (4): 54-62.

Coursey, D. G. (1973) .Cassava as Food Toxicity and Technology. In: Chronic Cassava Toxicity. Nestel, B. and P. Maclyntre (Eds).Proceedings of an Inter disciplinary Workshop. London 29-30.

Delange, E. and Ahluwalia, R. (1983). Cassava toxicity and thyroid: research and public health Issues. *Proceedings,International Workshop on Cassava Toxicity*, 31 May -2 June 1982, Ottawa, Canada. IDRC-207e: Ottawa.

Eruvbetine, D. (1995). Feed Enzyme- The Science, future developments and practical aspects in feed formulation. 10th *Eur. Symp.on Poultry Nutr*. October, 15-19, Antalya, Turkey, pp. 193-201.

Eruvbetine, D. and Afolami, C. A. (1992). Economic evaluation of Cassava (*Manihotesculenta*) as a feed ingredient for broilers. *Proc. Of The sixth world's poultry congress*, . Pp. 532-535.

Evabetine, M. R., Raji, M. N. and Durodola, O. (2002). Interaction between ingested feed and the digestive system in poultry. *Journal of Applied Poultry Resources., 5: 86-95.*

Egena, S. S. A. and Aya, V. E (2007). Performance and cost implication of feeding broilers with cornflakes waste based diet. *Au Journal of Technology*. 10(4): 232-236.

Gracia, O., and Dele, B. (1999). Adicao de complex multienzimaticoemdietas a base

de sojaextrusada e desempenho de corte. RevistaBrasileira de Zootecnia, (35) 2: 457-461.

Khempaka, L. and Gruptos, D. (2009). Feed Enzyme. In Feed Additives and Supplements (Proceedings 3rd Spring Conference).

Kana, M. and Campbell, R. (2012). Effects of organic acids, prebiotics and enzymes on control of necrotic enteritis and performance of broiler chickens, 2004. University of New England Armidale, NSW. Disponivelem: <http://www.jcu.edu.au/school/bms/ avpa/avpaconf _apr_2002/abstracts/choct.pd>Acess 09/27/06.

MC Donald, P. Edwards, R. A. and Greenholgh, J. F. G. (1995). *Animal Nutrition Fifth edition Longman Publisher*. Pp 221-235.

Olugbeme, N. and Parker, J. (2010). Enzyme supplementation of poultry diets based on viscous cereals. In: Bedford, M.R., Partridge, G.G. (Eds.). Enzymes in farm animal nutrition. Oxford shire: Cab Publishing, pp: 406.

Ojewola, D. (2006). Utilizacaodeenzimasnaalimentacaoanimal. RevistaEletrônica*Nutritime, 6: 254-267.*

Oke, G. D. and Oke, O. E. (2005). Effect of exogenous enzyme in diet on broiler performance. *International Journal of Poultry. Scoence*, 2: 168-173.

Oladipo, M. F., Onimisi, P. A., and Bawa, G. S. (. 2015). Response of broiler chickens fed Kaura variety of sorghum (*sorghum bicolor*) based diets supplemented with enzymes. *Nigerian Journal of Animal Science.* 17 (1):17-82

Onyimonyi A. A. and Okeke, L. (2005). The use of enzymes in poultry diets. *World Poultry Science Journal., 52: 61-68.59.*

Onyimonyi, A. A. (2002). Methionine as an additive to cassava based diets. In: Nestle, B. and Graham, M. (eds). Cassava as an animal feed. Proceedings of a workshop held at the University of Guelph, 18-20April 1976. Ottawa International Development Research Center, IDRC 095C. pp. 9-17.

Onyimonyi, A. A. and Onukwufor, J. S. (2003). Rate of passage of barley diets with chromium oxide: Influence of age and poultry strain and effect of Bglucanase supplementation. *Poultry Science.*, 73: 1433-1440.

Sanusi, A. L. (2011). Cyanogenicglycosides.InToxicants of plant origin, Vol. II, Glycosides. Ed. Cheeke, P.R. CRS Press, p. 43–60.

SPSS Statistical Package for Social Scientists, SPSS, (2012) 21Version.

Tewe, O. O. and Egbenike, G. N. (1992). Composiciónquímica de la ráiz y delashojas de algunasvariedades de yuca (*Manihotesculenta*).Turrialba 17(3):314-320.

Tewe, O. O. and Iyayi, E. A. (1989). Soy products as energy sources for poultry. In: Drackley, J.K. Soy in animal nutrition. Illinois. Savoy, IL, pp: 283-288.

Tuleum, C. D., Njike, M. C., Ikurior, S. A, Ehidou, N. G. (2005). Replacement of maize with cassava meal/brewer yeast sherry in the diet of broiler chicks.*Proceedings of 30th Annual Conference of Nigeria Society of Animal Production* 20th-24th March 2005. University of Nigeria.Nsukka.2005; 183- 185.