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

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ABSTRACT

A feeding trial was conducted at the Teaching and Research Farm, Oyo State College of Agriculture and Technology Igboora, Nigeria, to evaluate effect of feeding sun dried cassava extract starch pulp (SCSP) on performance characteristics and cost implication of broiler chicks. Two hundred (200) day-old cobs 500 broiler chicks were randomly allocated to five treatments T1 (control, 0%), T2 (10%), T3 (20%), T4 (30%), and T5 (40%) each having 40 birds, replicated 4 times 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 SCSP was also calculated. Significant ($P<0.05$) differences were observed on all the performance attributes evaluated except FCR. It was shown that SCSP is a potential source of energy; cost implication was least when SCSP replaced maize. It was concluded that best performance characteristics of broilers could be obtained when SCSP partially replaced maize at 20% levels of inclusion. It could be recommended that 30% inclusion levels of SCSP can be incorporated in broiler starter.

Keywords: Performance, sun dried cassava, broiler chickens cost.

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 had 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 could 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 could be replaced by cassava peel meal without deleterious effect on the carcass and organ characteristics and no pathological effects were 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 declined progressively as the quantity of cassava starch is increased in the diet (Ojewola *et al.,* 2006; Khempaka *et al.,* 2009). Earlier studies suggested that lower inclusion rates of 8–10% must be maintained. More recent studies with broilers suggested that a substantial proportion as much as 50 to 75–80%; (Olugbeme *et al.,* 2010; Kana *et al.,* 2012) of energy ingredients could be replaced with cassava chips or flour with no decrease in production, provided diets were 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 were 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 towards 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 experimental site was in forest zone of Latitude 7.43^{o}Nand Longitude 3.8^{o}E, with an elevation of 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 sheet 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 A.O.A.C., (2010) method. The metabolizable energy was calculated as described by Mc Donald (1995) as follows (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 after they were offered the experimental diets for the next 28 days of the experiment. Thereafter, five experimental diets were formulated having percentage crude protein that ranged between 20.70-22.15% with energy ranged between 2893.35–2979.30ME kcal/kg. Maize was the main energy source for the control diet whiles the other four dietary treatments (2, 3, 4 and5), 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 stabilize birds, thereafter, experimental diets were fed.

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
SDCSEP	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					
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: Sun-dried Cassava Starch Extract Pulp ME: Metabolizable Energy
Vit-Min Premix (Agricare-Mix, Pfizer Production Plc, Lagos, Nigeria) contained: Vitamin A, 12,000,000 IU; Vitamin D3 2,000,000 IU; Vitamin E 7,000IU; Vitamin B2, 4,000 mg; Nicotinic acid 15,000 mg; Calcium d-pentothenate 8,000 mg; Biotin 40mg; Vitamin B12 10mg; Mn 20,000 mg; Fe 50,000 mg; Zn 100,000 mg; Cu 10,000 mg; Iodine 750mg; Co 3000 mg

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.

Total weight gain (FWG): FWG was calculated by subtracting initial weight from final weight.

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

Weight gain (WG): The birds were weighed on weekly basis and the weight gain was calculated by subtracting weight of preceding week from current week

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

$$\textbf{FCR} = \frac{\text{Feed intake (g)}}{\text{Weight gain (g)}}$$

$$\textbf{Mortality} = \frac{\text{Number of dead birds}}{\text{Number of stock birds}}$$

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 (SPSS, 2012). Means were separated by using Duncan multiple range test of the same software.

Statistical Model

$Yijl = \mu + Ti + \sum ij$

Where: Yijl = Observed value of dependent variable

μ = population mean

Ti = effect of the ith treatment

∑ijl = Random residual error

RESULTS AND DISCUSSION

Results of the inclusion of sundried cassava starch extract pulp (SDCSEP) in the diet of broiler starter are shown in Table 2. Both final and weight gain were significantly affected ($p<0.05$) but birds fed control, 10, 20, and 30% diets were similar and had significantly higher body weight than 40%. This was an indication that nutrient utilization was better when sundried cassava starch extract pulp was substituted with maize up to 30%.

This finding support the report of Egena and Aya., (2007)which stated significant ($p<0.05$) difference when experimental diets were fed broiler starter. The reduced weight gain observed from birds placed on the (40% SDCSEP) diets could be attributed primarily to traces of anti-nutritional factors (ANFs) that bind nutrients which could have been available for tissue development and lower energy of the feed.

The values of feed intake observed in both control and test diets (10, 20, 30 and 40%) were statistically similar as showed in Table 2. The similar values of intake observed for birds fed control diet T1 and the last diets was evident that their combination improved feed intake. The high feed intake values observed for birds fed 30 and 40% was due to the fact that birds fed the SDCSEP found the diets digestible.

Feed conversion ratio (FCR) did not differ significantly ($p>0.05$) as shown in Table 2. This was an indication of the adequacy of nutrients in all the diets, which showed that diets were able to meet nutrient requirement of the broiler starter birds. FCR of this study was in line with Oladipo *et al.* (2015) who reported non-significant effect when birds were fed the experimental diets. The observed numerical values could reveal that SDCSEP 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 in increased weight gain except for 40% SDCSEP by causing degradation of fiber and non-starch polysaccharide components of the SCSP based diets into soluble metabolizable products (Aguihe *et al.*, 2015).

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

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

Parameter	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	SEM
Initial weight (g)	123.75^{b}	125.00^{a}	123.75^{b}	123.23^{c}	121.75^{d}	0.24
Final weight (g)	560.00^{a}	650.00^{a}	700.00^{a}	675.00^{a}	525.00^{b}	18.35
Weight gain (g)	436.25 ^{a}	525.00^{a}	576.25^{a}	551. 77 ^{a}	403.25^{b}	18.22
Feed intake (g)	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,d} 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

However, 30 and 40% SCSP were significantly (p<0.05) similar. Total cost of feed intake followed similar pattern with total feed intake per bird. Total weight gains (TWG) were also significantly (p<0.05) affected, the highest TWG of birds was obtained for 20% SCSP with values of 576.25g while lowest value of 403.25g was obtained on 20% SCSP. Cost of feed intake/weight gain was significantly (p<0.05) influenced by the experimental feed (SCSP), with highest value of 4.06 for 30% SCSP while 20% SCSP had least value of 2.57 but 10% SCSP and 20% SCSP were statistical similar.

Table 3 showed that the dietary inclusion of sundried cassava starch extract pulp increased the cost of producing one kilogramme of feed. The observation of this study was in disagreement with Ani *et al.*, (2013) who observed 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 10% and 20% SCSP revealed best results when compared with others.

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

	Level of Sun dried cassava starch pulp (%)					
Parameters	**0**	**10**	**20**	**30**	**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 bird (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}	551.7^{b}	403.25^{c}	13.68
Cost of feed intake/weight gain (kg)	3.00^{b}	2.57^{ca}	2.63^{ca}	2.97^{b}	4.06^{ac}	0.13

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

CONCLUSION

The study showed that sun dried cassava starch extract pulp is a potential source of energy and has valuable nutrients that could 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 of availability of conventional energy source (maize). In addition, cost

implication of the replacement is least when SCSP partially replaced with maize.

RECOMMENDATION

It is hereby recommended that 30% inclusion levels of sun dried cassava extract starch pulp be incorporated in broiler starter diet in order to have good profit.

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