International Journal of
Agriculture and Biosciences
www.ijagbio.com P-ISSN: 2305-6622 E-ISSN: 2306-3599 editor@ijagbio.com

RESEARCH ARTICLE

Performance and Hematological Parameters of Broilers Fed Graded Levels of a Mixture of Sun-Dried Cassava Tuber Meal, Brewers' Dried Grain and Palm Oil as a Substitute for Maize

U Okpanachi, *AA Musa and KE Idachaba

Department of Animal Production, Kogi State University, Anyigba, Nigeria

ARTICLE INFO

Received: February 12, 2013
Revised: March 22, 2013
Accepted: May 04, 2013

Key words:
Brewers dried grains
Broilers
Maize
Palm oil
Sun-dried cassava tuber meal

***Corresponding Address:**
AA Musa
mailraheem2003@yahoo.com

ABSTRACT

A 9-week study was conducted to evaluate the performance and hematological parameters of broilers fed graded levels of a mixture of sun-dried cassava tuber meal, brewers dried grains and palm oil (CBP-mix) as substitute for maize. The sun-dried cassava tuber meal, brewers' dried grains, and palm oil were mixed in a ratio of 60%, 35% and 5% respectively. 120 day old unsexed broilers (Anak strain) were randomly allotted into four dietary groups (T_1, T_2, T_3, and T_4) consisting of 30 broiler birds per treatment group in a complete randomized block design with 3 replicates for each treatment. T_1 contained 0% CBP-mix +45% maize, T_2 15% CBP-mix +30% maize, T_3 30% CBP-mix +15% maize and T_4 45% CBP-mix +0% maize. A significant decrease in feed intake was observed as the level of CBP-mix in broiler finisher diets increased ($P<0.05$). Broilers fed 45% CBP-mix diet recorded significantly ($P<0.05$) lower body weight, feed conversion ratio and feed cost per kg gain when compared to broilers on other experimental diets. However, feed conversion ratio and feed intake of birds fed 0, 15 and 30% CBP-mix diets were similar ($P>0.05$) at the starter phase. Body weight and feed conversion ratio of birds fed 0, 15 and 30% CBP-mix diets were comparable ($P>0.05$) at the finisher phase. The result on feed cost analysis showed that total feed cost and feed cost per weight gain decreased significantly ($P<0.05$) as the CBP-mix substitution levels for maize increased. The results obtained from the experiment showed that CBP-mix can be included up to 30% to substitute up to 66.6% of maize in both broiler starter and finisher diets without incurring any adverse effect on performance and hematological parameters of the birds. Furthermore, 30% CBP-mix diet gave a good feed conversion ratio, feed cost per kg and the best feed cost/ kg gain.

Cite This Article as: Okpanachi U, AA Musa and KE Idachaba, 2013. Performance and hematological parameters of broilers fed graded levels of a mixture of sun-dried cassava tuber meal, brewers' dried grain and palm oil as a substitute for maize. Inter J Agri Biosci, 2(3): 108-112. www.ijagbio.com

INTRODUCTION

Animal production in the tropics is adversely affected by high cost of feed and inadequate feed supply (Raviundran *et al.*, 1982), and this feed contributes to the total cost of production. Madubuike and Ekenyem (2001) mentioned broiler production as the quickest way of rapid protein supply in a short run. This is because it has a shorter market cycle and is much faster in growth than other non-ruminant livestock.

Esonu (2000) also mentioned that one of the most important factors militating against increased commercial poultry production in Nigeria is the high cost of conventional feedstuffs. The problem is attributed to competition between livestock and man for grains. For example maize is a major feedstuff and it is in high demand for consumption by both humans and livestock.

The competition and adequate supply have invariably led to their constant increasing market price. The high cost of maize and Soya beans is a major contributor to the increasing cost of poultry production. This has made many poultry keepers to reduce their flock or completely shift to other business with lesser financial involvement (Esonu, 2000).

Fetuga *et al.* (1975) had reported that a major factor militating against the rapid development of the livestock industry in Nigeria is the lack of adequate supplies of the feedstuff at economic prices. It therefore, becomes imperative to source for alternatives that will be cheaper than maize, readily available and easy to digest and utilize by poultry for productive purposes. The use of non-conventional feed material is one of the ways to reduce the cost of finished feeds (Apata and ologhoro, 1994). One of such feed material is a mixture of sun- dried cassava tuber meal, Brewers' dried grains (burukutu waste) and palm oil, (CBP-mix).

Eyenihi *et al.* (2008) described the sun – dried cassava tuber meal as a good source of carbohydrate, and brewer dried grains to be rich in protein, while he mentioned palm oil as a stabilizer with high energy source. Furthermore, Udedibie *et al.* (2008) in his work also stated that no side effects and mortality occurred from the consumption of CBP – mix in a ratio of 60%, 30% and 10% respectively. The study therefore aimed at evaluating the performance and hematological parameters of broilers fed graded levels of CBP-mix as a substitute for maize.

MATERIALS AND METHODS

Experimental Location and Diets

The experiment was carried out at the Poultry unit of the Kogi State University Livestock Teaching and Research Farm of the Department of Animal Production, Anyigba. The sun-dried cassava tuber meal, brewers' dried grains and palm oil were mixed in a ratio of 60%, 35% and 5% respectively. Four iso-nitrogenous diets were formulated with CBP–mix replacing maize at 0, 15, 30, and 45% levels of inclusion levels at both starter and finisher diets (Table 1). 120 day-old broiler chicks (Anak strain) were randomly divided into 4 treatments of 30 birds each. Each treatment was replicated 3 times with 10 birds per replicate. Sample of feeds were analyzed for their proximate chemical composition at the Animal Science Department Laboratory, Ahmadu Bello University, Zaria using the standard method described by A.O.A.C. (1995).

The experiment lasted 9 weeks i.e. 4 and 5 weeks for starter phase and finisher phase respectively. Feed and water were provided ad *libitum.* Other routine management practices were carried out.

Data Collection

At the beginning of the experiment the broiler chicks were weighed and subsequently weighed on weekly basis. The initial live weights were subtracted from final live weight to determine the weight gain of the animals. Feed offered to the birds were weighed daily and leftovers were also weighed to determine the feed intake of the birds. The weighing of birds and feeds were done using a precision weighing balance and the weights recorded to the nearest 0.01 g. Weighing of birds took place in the morning hours (6:30 - 7:30am local time) prior to feeding each week. Both values were used to determine the feed conversion ratio (FCR). Feed cost/kg gain was determined by multiplying the value of FCR by that of feed cost per kg of feed.

Hematological Studies

At the end of the feeding trial, blood samples were collected from 2 birds per replicate via the wing vein of the chickens using 5mL disposable syringes. The skin was damped with alcohol to disinfect the area and make vein visible. The blood was taken into the syringe and directly transferred into the labeled test tubes containing anti-coagulant (EDTA). The collected samples were taken immediately to the laboratory for hematological measures. The blood was analyzed for red blood cell count (RBC), Hemoglobin concentration (Hb), packed cell volume (PCV), white blood cell count (WBC), and white cell differential count by the methods of Baker *et al.* (1998), while the mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were according to the procedure of Harmening (2008).

Statistical Analysis

All the data collected were subjected to a one way analysis of variance in a completely randomized design (CRD) and LSD was used to separate the means. Both are contained in SPSS package –version 15.

RESULTS

The proximate composition of the experimental diets at starter and finisher phases are shown in Table 2. The crude protein, oil and fat values did not indicate much marked difference between diets. The diet with 30% level of CBP-mix had the slightly highest value of NFE, crude fiber, ash and lower crude protein compared to other diets. 45% CBP-mix diet had the highest level of crude fiber at the starter phase due to the high level of inclusion of CBP-mix.

Performance characteristics of broilers fed graded levels of CBP-mix at starter phase are shown in table 3. Body weight of birds fed 0% CBP-mix was significantly ($P<0.01$) higher than birds on other experimental diets. Birds fed 45% CBP-mix had lower ($P>0.01$) body weight when compared to birds fed 15 and 30% CBP-mix diets. Feed intake reduced with increase in inclusion level of CBP-mix in the diet. Birds fed 0% CBP-mix had the highest feed intake which was significantly ($P<0.05$) different from the values obtained for feed intake of birds fed 45% CBP-mix diet. However, feed intake of birds on 15, 30 and 45% CBP-mix diets were comparable ($P>0.05$). FCR values of birds fed 0, 15 and 30% CBP-mix were not significantly ($P>0.05$) different from each other which were on the other hand significantly ($P<0.05$) different from the value obtained for birds fed 45% CBP-mix diet. Feed cost was significantly ($P<0.01$) different across the experimental diets and reduced with increase in CBP-mix inclusion level in diets.

Performance of broiler finisher fed graded levels of CBP-mix is presented in table 4. Values for body of birds fed 0, 15 and 30% CBP-mix diets were significantly ($P<0.05$) higher than birds fed 45% CBP-mix. Values of body weight of birds on 0, 15 and 30% CBP-mix declined numerically with increase in CBP-mix in diets but did not show significant ($P>0.05$) difference statistically. Feed conversion ratio of birds on experimental diets followed the same trend as body weight. Feed intake was highest ($P<0.05$) for birds on 0% CBP-mix, when compared to birds fed on other experimental diets. However, feed intake of birds fed 15, 30 and 45% CBP-mix diets were comparable. Feed cost / kg gain was best ($P<0.05$) in birds on 30% CBP-mix diet when compared to birds on 45% CBP-mix diet. However, values obtained for birds on 0, 15 and 30% CBP-mix were comparable.

Tables 5 and 6 showed the values obtained for hematological parameters measured at week 4 and 9

Table 1: Composition of the Experimental Diets (%)

Ingredients	Starter phase				Finisher phase			
	T1	T2	T3	T4	T1	T2	T3	T4
CBP – mix	0.00	15.00	30.00	45.00	0.00	15.00	30.00	45.00
Maize	45.00	30.00	15.00	0.00	45.00	30.00	15.00	0.00
GNC	36.80	37.28	36.41	36.38	27.68	28.02	28.02	27.11
Maize Offal	11.46	10.97	11.84	11.87	21.07	20.73	20.73	21.64
Fish meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Bone meal	3.50	3.50	3.50	3.50	3.00	3.00	3.00	3.00
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis								
ME (Kcal/Kg)	2787.88	2688.53	2610.35	2521.18	2824.68	273.58	2645.33	2558.35
CP (%)	23.00	23.23	23.00	23.00	20.00	20.00	20.00	20.00
Ca (%)	1.312	1.35	1.38	1.42	1.33	1.39	1.39	1.43
P (%)	1.22	1.05	1.03	1.01	1.01	0.98	0.98	0.96

Key: CBP-mix= sun-dried cassava tuber meal, brewers dried grains and palm oil; GNC= groundnut cake; ME= metabolizable energy; CP= crude protein; Ca- calcium, P= phosphorus

Table 2: Proximate Chemical Composition for Experimental Diets (%DM) and Test Diet (%)

	Starter phase					Finisher phase			
Nutrients (%)	T1	T2	T3	T4	Test diet	T1	T2	T3	T4
CP	15.48	17.34	12.55	13.68	5.95	11.79	13.05	7.65	10.98
CF	9.40	10.70	10.80	11.50	8.39	9.78	8.78	10.02	9.33
EE	5.20	4.89	5.00	4.90	6.19	4.56	4.19	4.37	3.96
ASH	7.12	5.89	7.50	6.84	5.52	6.11	4.87	6.40	5.83
NFE	65.50	70.04	71.56	70.20	73.95	67.76	72.11	71.56	71.10
DM	91.04	93.88	92.57	95.40	92.22	91.66	94.88	93.56	94.57

Key: DM= dry matter; CP=crude protein; CF=crude fiber; EE= ether extract; NFE= nitrogen free extract

Table 3: Performance of Broilers Starter fed Graded Levels of CBP-mix (0-4weeks).

Parameters	Treatment				LOS
	T1	T2	T3	T4	
Initial body weight (g)	80.00±0.00	80.00±0.00	80.00±0.00	80.00±0.00	
Final body weight (g)	750±17.32 [a]	655±29.62 [b]	656.67±19.6 [b]	550±11.55[c]	**
Total weight gain (g)	670±17.32 [a]	566.67±29.6 [b]	566.67±17.0 [b]	470±11.55 [c]	**
Daily weight gain (g)	23.96±0.31 [a]	20.20±0.53 [b]	20.24±0.31 [b]	16.79±0.21 [c]	**
Total feed intake (g)	752.92±39.2[a]	703.92±11.2[ab]	679.56±10.00[ab]	666.04±41.2[b]	*
Daily feed intake (g)	26.89±0.70 [a]	25.14±0.19 [ab]	24.27±0.18 [ab]	23.68±0.74 [b]	*
F C R	2.25±0.09 [a]	2.45±0.12 [a]	2.36±0.07[a]	2.83±0.15 [b]	*
Feed cost (₦)/kg	94.7±0.00 [d]	91.13±0.00 [c]	86.45±0.00 [b]	80.40±0.00 [a]	**
Feed cost/kg gain (₦)	213.14±1.76	223.57±10.63	204.02±6.25	227.26±12.4	NS

Key: a,b,c,d= Treatment means with different superscript on the same row differ significantly (P< 0.05); LOS = level of significance; ** = highly significance (P< 0.01); *= significant (P< 0.05); N.S= Not Significant

respectively. There was no significant difference (P>0.05) in all the hematological parameters measured at both phases of the experiment.

DISCUSSION

The crude protein of the test diet obtained in this study is 5.95% which is lower than the 10% CP reported by Udedibie and Enang (2009). The difference may have been due to the fact that the proportion of CBP-mix (60:35:5) used in this study was different from the 60:30:10 used by Udedibie and Enang (2009).

Feed intake showed significant differences (P<0.05) among treatment means at both starter and finisher phases, with birds on 0% CBP-mix diet having the highest feed intake value and birds on 45% CBP-mix diet with the lowest. This is similar to the findings of Udedibie *et al.* (2012) who reported that there was no significant difference in feed intake of laying hens fed CBP-mix (60:30:10), however birds fed CBP-mix had numerically lower feed intake. This is however, not in line with the findings of Udedibie and Enang (2009) who reported that feed intake of broilers was higher in diets containing CBP-mix. These differences may be due to the lower proportion of palm oil inclusion in CBP-mix used in this study, ingredients used, season during which the experiment was conducted and method of preparation. However, this is in line with the findings of Oluyemi and Roberts (1979) who reported that the feed intake of broilers could be adversely affected if the fiber content of their diet is high.

The group on CBP-mix had lower body weight when compared to the group on the control diet (0% CBP-mix). This contradicts the reports of Udedibie *et al*. (2012) who reported that birds fed CBP-mix in the ratio of 60:30:10 gained more weight than those on the control diet (0% CBP-mix) at 50% CBP-mix inclusion level in the diet. On the other hand, the current research agrees with the reports by Chukwuka *et al.* (2010) who observed a decrease in body weight of birds with increase in CBP-mix inclusion

Table 4: Performance and bio-economics of broilers fed graded levels of CBP-mix (4-9weeks).

	Treatment				
Parameters	T1	T2	T3	T4	LOS
Initial body weight (g)	655.5±1.10	655.1±1.12	655.3±1.21	655.0±1.11	NS
Final body weight (g)	2510±70.00[a]	2420±75.72[a]	2366±70.82[a]	1870±62.43[b]	*
Total weight gain (g)	1854±47.26 [a]	1764±46.19 [a]	1710±10.00 [a]	1215±37.56[b]	*
Daily weight gain (g)	53.01±0.87[a]	50.63±0.83 [a]	49.05±0.18 [a]	34.16±0.67[b]	*
Total feed intake (g)	3774.81±138.06[a]	3629.64±129.64[ab]	3333.3±88.2[b]	3336.5±143.9[b]	*
Daily feed intake (g)	107.84±2.47[a]	103.68±2.32[ab]	95.24±1.58[b]	95.31±2.57[b]	*
F C R	2.03±0.20[a]	2.06±0.14[a]	2.01±0.92[a]	2.65±0.34[b]	**
Feed cost (₦) /kg	87.87±0.00[d]	84.09±0.00[c]	80.05±0.00[b]	73.35±0.00[a]	**
Feed cost/kg gain (₦)	179.24±17.75[ab]	172.99±11.85[ab]	156.02.67±7.4[a]	201.45±9.39[b]	*

Key: a,b,c,d= Treatment means with different superscript on the same row differ significantly (P<0.05); LOS = level of significance; ** = highly significance (P< 0.01); *= significant (P< 0.05); N.S= Not Significant

Table 5: Hematology profile of broilers fed graded levels of CBP-mix at week 4

	Treatment				
Parameters	T1	T2	T3	T4	LOS
PCV	39.26±0.94	35.55±4.57	33.39±1.57	39.51±1.23	N.S
RBC	6.94±0.57	5.17±2.19	6.44±0.52	6.21±1.77	N.S
WBC	8.64±1.77	5.23±0.87	4.48±0.57	6.90±0.97	N.S
Hb	192.00±22.74	174.67±37.16	103.00±3.51	167.33±21.79	N.S
MCV	99.33±6.06	83.67±8.17	88.33±12.98	112.67±11.85	N.S
MCH	306.80± 90.05	333.67±34.52	162.50± 14.98	288.77±67.75	N.S
MCHC	492.17±68.55	479.17±50.69	330.27±20.99	420.97±43.11	N.S

Key: RBC= red blood cell count; Hb= Hemoglobin concentration; PCV= packed cell volume; WBC= white blood cell count; MCV= mean corpuscular volume; MCH= mean corpuscular hemoglobin; MCHC= mean corpuscular hemoglobin concentration; N.S = Not significant

Table 6: Hematology profile of broilers fed graded levels of CBP-mix at week 9

	Treatment				
Parameters	T1	T2	T3	T4	LOS
PCV	39.26±0.94	35.94±4.79	33.25±1.53	39.20±1.25	N.S
RBC	6.93±1.17	5.16±0.88	6.44±0.57	6.21±0.94	N.S
WBC	8.62±0.56	5.23±2.20	4.47±0.56	6.90±1.76	N.S
Hb	191.00 ±23.30	174.67±37.16	103.33±3.38	167.33±21.79	N.S
MCV	72.00±32.19	87.00±12.01	88.67±12.91	112.00±11.37	N.S
MCH	306.77±90.55	333.70±34.50	162.43±14.93	288.70±67.75	N.S
MCHC	492.17±68.55	479.13±50.67	310.93±26.22	420.97±43.14	N.S

Key: RBC= red blood cell count; Hb= Hemoglobin concentration; PCV= packed cell volume; WBC= white blood cell count; MCV= mean corpuscular volume; MCH= mean corpuscular hemoglobin; MCHC= mean corpuscular hemoglobin concentration; N.S = Not significant

level in the diets. It is also in line with the findings of Udedibie *et al.* (2008) and Enyenihi *et al.* (2009) on body weight changes of laying hens fed cassava tuber meal-based diets. This might be as a result of increasing fiber level with increase in CBP-mix in diet. This is in line with the findings of Rausch and Belyea (2006) who reported that high fiber levels in the diet of monogastric animals are associated with reduced nutrient digestibility.

CBP-mix groups recorded significantly (p>0.05) analogous FCR with that of the control group. The cost of feed decreased with increasing CBP-mix level such that the control diet was ₦357, ₦825 and ₦1430 for starter and ₦378, ₦782 and ₦1450 for finisher on a 100kg basis which is more expensive than the 15, 30 and 45% CBP-mix diets, respectively.

The results of the hematological parameters showed that there was no significant difference (p>0.05) for all the parameters measured. Values of PCV, Hb, MCH, WBC, RBC, MCV, and MCH in this study were similar to the values earlier reported by Abimbola (2007) for broilers. The results obtained are also in line with the findings of Lucas and Jamroz (1961).

Conclusion

The results obtained from the experiment showed that: CBP-mix can be included up to 30% to substitute up to 66.6% of maize in both broiler starter and finisher diets without incurring any adverse effect on performance and hematological parameters of the birds. Furthermore, 30% CBP-mix diet gave a good FCR, feed cost per kg and the best feed cost per kg gain. The lower feed cost per kg meat produced suggest that CBP-mix is an economically viable alternative but it is advisable that diets containing CBP-mix should not be allowed to remain for a long time in order to avoid spoilage that could occur attributable to oxidative rancidity of palm oil.

REFERENCES

AOAC, 1995. Official methods of analysis of the Association of Official Analytical Chemists. 15th edition, Washington, DC.

Apata DF and AD Ologhoro, 1994. Biochemical evaluation of some Nigeria legume seeds. Feed chemistry, 49: 33-38.

Baker FI, RE Silverton and CJ Pallister, 1998. Baker and Silverton's Introduction to Medical Laboratory Technology, 7th edition. Bounty Press Ltd, Nigeria, pp: 339-373.

Chukwuka OK, ABI Udedibie, NJ Okeudo, NO Aladi, BO Esonu, OOM Iheshiulor and AA Omede, 2010. Report and Opinion, 2: 104-110.

Enyenihi GE, ABI Udedibie, MJ Akpan, OL Obasi and IP Solomon, 2008. Effects of 5 hours wetting of sun-dried cassava tuber meal on the HCN content and dietary value of the meal for laying hens, In: proc. 33rd Annual conf. of NSAP. 16th-20th march 2008 at Ayetoro-Ogun state pp: 441-444.

Enyenihi GE, ABI Udedibie, MJ Akpan, OL Obasi and IP Solomon. 2009, Effects of 5-hr wetting of sun-dried cassava tuber meal on the HCN content and dietary value of the meal for laying hens. Asian Journal of Animal and Veterinary Advances, 4: 326-331.

Esonu BO, 2000. Animal nutrition and feeding: A functional Approach. Memory press, Owerri, Nigeria, pp: 198-204.

Fetuga BL, GM Babatunde, OA Olusanya and VA Oyenuga, 1975. The composition, nutrients digestibility and energy value of maize cobs, yam peels and plantain peels for three weight groups of pigs. Nigerian Journal of Animal Production, 2: 95-100.

Harmening DM, 2008. Clinical Haematology and Fundamentals of Hemostatis, (5th ed) Philadelphia: A Davis company.

Lucas AM and C Jamroz, 1961. Atlas of avian haematology. US Department of Agriculture, Washington, DC, pp: 271.

Madubuike FN and BU Ekenyem, 2001. Non-ruminant livestock production in the tropics. Gust Chucks Graphics Center, Owerri, Nigeria, pp: 120-145.

Oluyemi JA and FA Roberts, 1979. Poultry production in warm wet climates. The Macmillan press ltd. London, pp: 134.

Rausch KD and RL Belyea, 2006. The future of byproducts from corn processing. Applied Biochemistry and Biotechnology, 128: 47-86.

Raviundran VE, KE Komegay and J Web, 1982. Nutrients characterization of feed stuffs of Srilanka. J Nat Agric, 7: 19-22.

Udedibie ABI and MT Enang, 2009. The potentials of a mixture of sun-dried cassava tuber meal, brewers dried grains and palm oil as a substitute for maize in broiler diets. Nigeria Society for Animal Production 34th Annual conference, pp: 309-311.

Udedibie ABI, GE Enyenihi, MJ Akpan, OL Obasi and IP Solomon, 2008. Physiological Nature and Nutritive value of dried cassava fufu meal for laying hens. Nigerian Agricultural Research, 39: 44-49.

Udedibie ABI, OJ Chukwurah, GE Enyenihi, HO Obikaonu and IC Okoli, 2012. The use of sun-dried cassava tuber meal, Brewers' dried grains and palm oil to simulate maize in the diet of laying hens. Journal of Agricultural Technology, 8: 1269-1276.