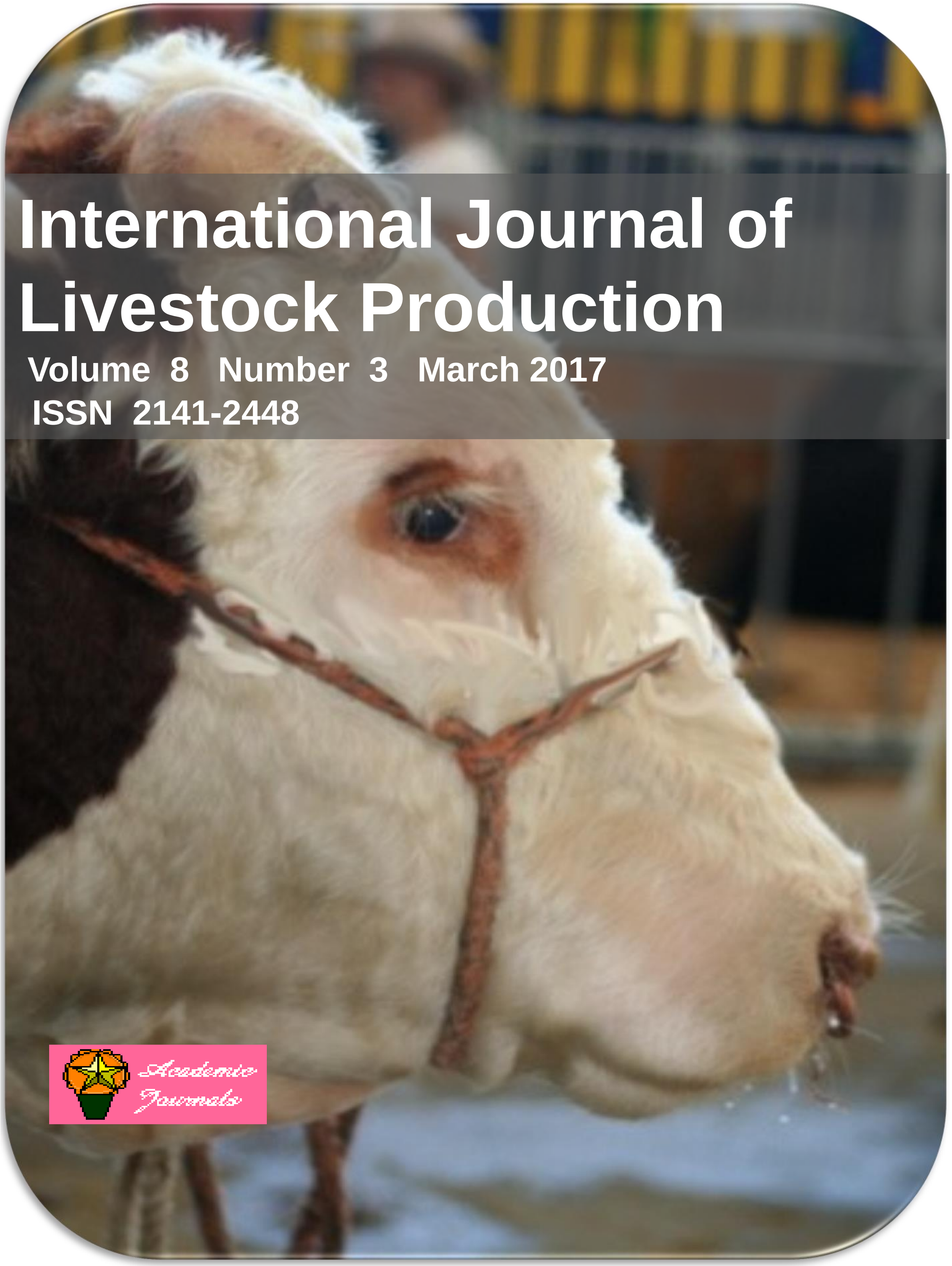
International Journal of Livestock Production

Volume 8 Number 3 March 2017
ISSN 2141-2448



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International Journal of Livestock Production (IJLP) (ISSN 2141-2448) is monthly (one volume per year) by Academic Journals.

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International Journal of Livestock Production

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academicJournals

Vol. 8(3), pp. 28-32, March 2017
DOI: 10.5897/IJLP2015.0222
Article Number: EB7C05963196
ISSN 2141-2448

http://www.academicjournals.org/IJLP

International Journal of Livestock Production

Full Length Research Paper

Effects of dietary inclusion of cassava root flour in broiler diets on growth performance, carcass characteristic and haematological parameters

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Received 13 September, 2015; Accepted 29 September, 2016

A 42-day study was carried out with ninety 14-day old broiler chickens (Cobb 500) to evaluate the dietary inclusion of cassava flour in full replacement with maize on growth performance, carcass characteristics and haematological parameters. The chickens were randomly allotted to 6 pens involving two dietary treatments of three replicates per each treatment and 15 birds per each replicate in a Complete Randomized Design. Variables measured included feed intake, weight gain, feed conversion efficiency, mortality, feed cost, and haematology. Feed and water were provided ad libitum. Results indicated that the total inclusion of cassava flour in broiler diet reduced ($P>0.05$) feed intake. Also, there was a depression ($P<0.05$) in the growth rate and feed efficiency in the broiler chickens fed on the cassava flour based diets during experimental period. Again, replacing maize with the cassava flour in broiler diet reduced ($P<0.05$) the dressing percentage of carcass. However, haematological parameters were not affected by dietary treatments. Nonetheless, the cost of feed was reduced with the substitution of maize with cassava flour in broiler diet. In conclusion, the total replacement of maize with cassava flour in broiler chickens diets has deleterious effect on growth, but reduced the cost of feeding, thereby resulting in higher net revenue.

Key words: Cassava root flour, dietary inclusion, performance and broiler chicken.

INTRODUCTION

The majority of components in commercial poultry diets comprise of cereal grains as energetic feedstuffs. In this regard, maize is the commonly used cereal (about 45 to 60% of diets) in poultry diets because of its high energy content and low anti-nutritional factors (Donkoh and Attoh-Kotoku, 2009). However, in the production of cereal grains, maize is not adequate for direct human consumption, formulating livestock diets, and for other industrial uses. These shortages have led to an increase in the price of maize. This has in turn, led to high cost of production in intensive poultry production enterprises. The competition for cereals in the human and livestock industry makes it important to explore the potentials of other energy sources such as cassava root as alternative for maize in poultry diets (Bhuiyan et al., 2012) Cassava (Manihot esculenta, Crantz) is one of the most important

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food crops in the humid tropics such as African countries. It can be produced well in soils with low fertility. It is able to survive drought conditions (Burrell, 2003). It is the most productive crop in terms of energy yield per unit land area (Ravindran and Blair, 1992). Among the starchy staples, it gives carbohydrate yield of about 40% higher than rice and 25% more than maize, making it the cheapest source of calories in animal diets (Tonukari, 2004). It has energy value of more than 3000 MJ metabolizable energy per kg and contains 2.55% CP, 27.75% CF, 0.12% EE and 1.70% ash on a DM basis (Sriroth et al., 2000). Cassava however contains cyanogenic glucosides of which its hydrolysis yields hydrocyanic (HCN) and this component is toxic to poultry (Udedibie et al*.,* 2008). The cyanide can be removed to tolerable level by boiling, drying, grating, soaking, fermentation, or a combination of these processes to produce final products containing not more than 100 ppm HCN (Udedibie et al., 2009). Again, as a partial energy source for poultry, cassava root contains very little protein which is low in quality. Diets containing cassava therefore need to be supplemented with more protein or synthetic amino acid to make up for the protein deficiency in it. The aim of this study was therefore to examine the response of broiler chickens to cassava flour-based diets supplemented with lysine and methionine.

MATERIALS AND METHODS

The experiment was conducted at the poultry section of the Department of Animal Science, College of Agriculture Education, University of Education, Winneba – Ashanti Mampong. In this study, a total of 90 14-day old Cobb 500 unsexed broiler chicks procured from Darko Farms Ltd. in Kumasi, Ghana were used. Before the trial, they were reared under the same conditions according to the breed management guidelines. All the chicks were fed a commercial broiler starter diet during the two weeks. They were then randomly allotted to six floor pens including two dietary treatments with three replicates per each treatment. Each replicate contained 15 broiler chickens. Each pen measured 3.5m by 1.5m allowing a floor space of 0.27 m^2 per bird. The two diets contained respectively 0 and 58 percent cassava root flour and replaced equal quantity of maize in the control. The two diets were formulated to meet the nutrient recommendations (NRC, 1994) for growing broiler chickens. The diets and their nutrient composition are presented in Table 1. The two experimental diets were analyzed for their proximate constituents by AOAC (1990) methods as presented in Table 1. The proximate components are also shown in Table 1. Feed and water were supplied *ad libitum* and the trial lasted from 14 to 56 days. The pens were filled with wood shaving as litter material to a depth of about 4cm. The birds were kept under a 12L: 12D lighting schedule throughout the study.

Live body weight at day 14 and 56 days of age, feed intake, weight gain and feed conversion ratio (FCR) were measured. For the measurement of carcass characteristics, two birds (1 male and 1 female) were randomly selected per each replicate at 56 days of age. They were weighed and killed by mechanical stunning and subsequent neck dislocation. The liver, crop, gizzard, heart and small and large intestines were trimmed of fat and then weighed. Haematological parameters including WBC, RBC, HB, MCH, MCHC, HCT, and MCV were assessed at the end of the experiment. Blood samples (about 2 mL) were drawn from the ventral lateral wing vein of two randomly selected birds from each replicate into EDTA-containing vacutainer tubes and haematological values analyzed immediately. The statistical analysis of t-test was conducted on the key parameters and the differences between treatments means were subjected to the test of significance at 5% probability.

Table 1. Experimental diets and their proximate composition.

Components	T_1 (%)	T_2 (%)
Maize	58	-
Fish Meal (64% CP)	10	10
Fish Meal (52% CP)	7	6
Cassava flour	-	58
Soybean meal (45% CP)	10.5	10.5
Wheat bran	12	12
Oyster shell	1	1
Vit/mineral premix	0.5	0.5
Salt	0.5	0.5
Di-calcium phosphate	0.5	0.5
Lysine	-	0.5
Methionine	-	0.5
Proximate composition (%):		
Dry matter	92.0	88.5
Crude Protein	19.7	20.0
Crude Fibre	2.9	3.7
Ether Extract	1.5	1.0
Ash	8.0	10.5
Nitrogen free extract	59.9	53.3
Calculated composition (%) :		
Crude Protein	22.3	19.6
Crude Fibre	3.3	6.6
Ether Extract	4.2	2.3
Ash	3.1	2.7
Methionine + cysteine	1.3	1.6
lysine	0.5	0.9
Calcium	1.0	1.0
Available Phosphorus	0.7	0.6
ME kcal/kg	2,984.7	2,938.03

Composition of vitamin/mineral premix per kg: Vitamin E, 25mg; Vitamin A, 6250 IU; Vitamin D3, 1250 IU; Vitamin K3, 25 mg; Vitamin B1, 25 mg; Vitamin B2, 60 mg; Vitamin B6, 40 mg; Vitamin B12, 2 mg; Elemental calcium, 25 mg; Elemental phosphorus, 9mg; Elemental magnesium, 300 mg; Iron, 400 mg; Selenium 1.0 mg, Iodine 20 mg, Copper 60mg, Magnesium 100mg, cobalt 10 mg, Zink, 150 mg; Sodium Chloride, 1.5 mg; Choline Chloride, 500 mg; Live Lactobaccillus spore, 0.2 million cfu; Niacin, 40mg; Folic Acid, 10mg; d-Biotin, 5 mcg.

RESULTS AND DISCUSSION

The results of proximate analysis of the experimental diets as shown in Table 1, revealed that the crude protein

Table 2. Effects of the dietary treatments on the performance of broilers.

Parameter	T_1	T_2	SEM	Level of Sig.
Initial weight (g/bird)	273.33	273.33	_	_
Final weight (g/bird)	2237.3	1825.1	147.19	0.049*
Final weight gain (g/bird)	1964.0	1551.8	147.19	0.049*
Daily weight gain (g/bird)	46.77	36.95	3.49	0.048*
Feed intake (g/bird/day)	122.23	111.87	6.46	0.184^{NS}
Feed Conversion Efficiency(FCR)	2.62	3.03	0.11	0.021*
Mortality (%)	11.11	24.44	7.37	0.145^{NS}

^{NS}= Not Significant, *= Significant.

Table 3. Effects of the experimental diets on the carcass characteristics.

Parameter (% of live weight)	T_1	T_2	SEM	Level of Sig.
Carcass weight (g)	2298.3	2198.3	2.36	0.00*
Dressed weight (g)	1891.7	1553.3	8.98	0.00*
Dressing percentage (%)	82.07	67.6	0.63	0.00*
Weight of head	2.1	2.3	2.36	0.101^{NS}
Weight of liver	2	2.1	3.73	0.678^{NS}
Weight of intestine(empty)	4.1	4.2	3.77	1.624^{NS}
Weight of intestine(full)	6.5	7.7	2.83	0.00*
Weight of gizzard(empty)	1.7	1.7	1.2	0.795^{NS}
Weight of gizzard(full)	3.4	3.4	1.41	1.00^{NS}
Weight of crop(empty)	0.2	0.1	0.09	0.00*
Weight of crop(full)	1.7	0.2	1.37	0.00*
Weight of shank	4.2	3.4	1.41	0.00*
Weight of heart	0.5	0.39	1.67	0.374^{NS}

NS= Not Significant, *= Significant.

content of the two diets were almost similar. The supplementation of the cassava flour-based diet with lysine and methionine had increased its crude protein level. According to Zanu and Dei (2011) broiler diet based on cassava meal was improved nutritionally by the addition of a little more protein. Completely substituting maize with cassava flour decreased (P<0.05) the body weight by 56 days of age (Table 2). Hassan et al. (2012) reported a considerable decrease in average daily weight gain when cassava flour was substituted with maize at 50, 75 or 100% in broiler diets. In their work, the birds fed on 75 or 100% inclusion levels of cassava meal had the lowest growth performance as compared to those on the other dietary treatments. They reported that using 25% of cassava meal in placing of maize had no adverse effects on broiler performance. There were no differences in feed intake between the treatments. There was however, 8.5% decrease (P>0.05) in feed intake of birds fed the diet containing the cassava flour. In contrast, Ukachukwu (2005) and Hassan et al. (2012) also reported a decline in feed intake of birds fed cassava-based diets, and this negative effect was increased as the inclusion level of the cassava in the diet increased. This could have also been due to the dusty nature of the cassava flour. Results of a trial by Udedibie et al. (2008) indicated improved feed intake of layers when cassava tuber meal was processed into pellets, confirming the observation that the dusty nature of the diet was responsible for low feed intake. The lower feed intake in broiler chickens fed diets based on cassava flour in this study led to a decrease in body weight, weight gain and decrease FCR.

Mortality was not significantly affected by dietary treatments. In this study two birds offered the test diets died. But their death could not be attributed to the inclusion of cassava flour in the diet.

Carcass weight, dressed weight and dressing percentages of the broiler chickens decreased (P<0.05) and the weight of intestines with digesta increased (P<0.05) when cassava flour based diet was offered (Table 3). The lower weight of carcass, dressed weight and dressing percentage were due to the poor growth performance of these birds. The reason for the higher

Table 4. Effects of the dietary treatments on haematology.

Parameter	T_1	T_2	SEM	Level of Sig.
WBC (×103/µl)	237.67	235.97	3.24	0.628^{NS}
RBC (×106/µl)	2.59	2.35	0.188	0.260^{NS}
HB (g/dl)	10.07	9.8	30.86	0.383^{NS}
MCH (pg)	42.7	41.33	0.79	0.158^{NS}
MCHC (g/dl)	32.43	32.18	0.37	0.536^{NS}
HCT (%)	31.03	30.07	1.48	0.550^{NS}
MCV (fL)	131.53	128.42	1.75	0.149^{NS}

^{NS}= Not Significant.

Table 5. Cost and benefits of feeding the two diets.

Parameter	T_1	T_2
Feed cost / kg diet (GHC)	1.31	0.69
Feed intake /bird/day (g)	122.2	111.9
Number of days on feed	42	42
Number of birds	40	40
Total cost of feed/bird/period (GHC)	7.00	3.65
Price per kg weight of bird (GHC)	6.00	6.00
Average live weight of bird (kg)	2.24	1.83
Value of bird (GHC)	13.44	10.98
Net revenue (GHC)	6.44	7.33

weight recorded for intestine with digesta may be partly due to delay in the digestion of cassava flour in the gastro-intestinal tract of the birds (Bhuiyan and Iji, 2015). The weight of crop with or without digesta reduced in birds fed on diets containing cassava flour. However, this observation was in contrast with results reported by Vantsawa (2007), in which the weight of crop of the chicks fed on diets supplemented with low-grade cassava meal was increased. The health of the birds as assessed by haematological analysis of birds was not affected by dietary inclusion of cassava flour (Table 4). All the assessed haematological parameters including WBC, RBC, HB, MCH, MCHC, HCT, and MCV were within the reference range of healthy birds (Campbell et al., 2003). Unigwe (2011) and Hassan et al. (2012) reported no detrimental effect on blood haematology parameters when cassava meal was fed to broiler chickens. Comparison of economics of feeding broiler chickens with substituting maize with cassava flour indicated a 48% reduction in the total cost of feed per bird when cassava flour was included in the diets instead of maize. This implies that it was more cost-effective to use cassava flour in substitute for maize in broiler diets. Even though the growth of the birds on the cassava-based diet was significantly affected, the net revenue realized for using the test ingredient was increased as shown in Table 5. The price per kilogram of maize and cassava flour at the time of the experiment was £ 0.56 (GH¢ 1.25) and £ 0.36 (GH¢ 0.85) respectively. The above findings confirm report by Vantsawa et al. (2007) that the use of cheaper feed resources as a feedstuff in poultry nutrition boost profit margin of farmers.

Conclusion

Replacing maize with cassava root flour at 100% of inclusion rate in broiler chicken's decreased the weight gain and FCR, as well as carcass weight and dressing percentage. But haematological indices were not affected by dietary inclusion of cassava flour. It seems that lower inclusion rate might be preferred in broiler chicken diets. Clearly, more research is needed to understand the mechanisms of decreasing performance of birds by dietary inclusion of cassava flour in their diets. However, the net revenue of feeding the broiler chickens with the diet containing cassava flour increased.

Conflict of Interests

The authors have not declared any conflict of interests.

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