Nutritive evaluation of different energy sources in broiler chicken diets under the tropical climate of Nigeria

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Abstract

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This study was aimed at evaluating the nutritive value of different sources of energy in broiler chicken diets on the growth performance and haematological parameters of broiler chickens. Five isonitrogenous and isocaloric diets (23.17% CP; 2831 Kcal/ME; 21.73% CP; 2929Kcal/ME) for the broiler starter (0-4 weeks) and finisher phases (5-8 weeks), respectively were formulated. Treatment 1 is the control diet while treatments 2, 3, 4 and 5 were sorghum, pearl millet, cassava and sweet potatoes based diets, respectively. A total of 225, 1 day-old NAPRI X broiler chicks were randomly allotted to the five treatments with three replicates each in a Completely Randomized Design (CRD). Data were subjected to ANOVA_{0.05}. The results showed that final body weights (503.44 g and 2302.77 g), feed intake (819.67 g and 3073.70 g) and weight gained (453.61 g and 1892.07 g) were significantly ($P<0.05$) higher in birds fed millet diets (T3) than other treatments for both starter and finisher phases, respectively. T3 (millet based diet) recorded significantly ($P<0.05$) the best feed conversion ratio (1.62) and the lowest feed cost per kg weight gain (145.90) at the finisher phase while chicks fed the control (maize based diet (T1) and sorghum (T2) based diet gave similar ($P>0.05$) values as those fed T3 (millet based diets). Birds fed diet T5 (sweet potatoes) gave significantly ($P<0.05$) lowest values in all parameters measured and poor feed conversion ratio at the starter phase. Similar pattern was also observed in the finisher phase except in feed intake and mortality which were comparable with other dietary treatments. Dietary treatments had significant ($P<0.05$) effect on white and red blood cells of broiler birds fed different energy sources. Millet based diet was the best in terms of nutritive value and also in terms of cost of production without compromising productivity in broiler chickens. It is also recommended that other methods of processing millet should be exploited.

Keywords: Feedstuff, nutritive value, energy sources, hematological parameters

Introduction

Animal agriculture in developing countries such as Nigeria is confronted with various challenges. These problems include feed shortage, high prices of feedstuffs and climate variations (Belewu *et al.*, 2007). Protein and energy are the most costly components in poultry diets, especially the plant protein (Mukhtar, 2007). The effects of these challenges have reflection on the quality and quantity of animal protein available for human consumption (Agbabiaka, 2010) and the health status.

The major factor militating against increase in poultry production is the non-availability of feed at economic price. Most of the energy concentrates are very expensive since they are also staple food for our ever-increasing human population. However, there is a need to evaluate different energy sources so as to make better choices of which to use when all are available and when prices of the conventional energy sources such as maize is high, information on other sources become necessary to keep production on. Therefore, the aim of this

study is to compare the *growth performance and haematological parameters* of broilers chickens fed maize, sorghum, millet, cassava and sweet potatoes as energy sources.

Materials and methods

A total of two hundred and twenty five (225) day-old broiler chicks (mixed sexes) were used for the research from the National Animal Production Research Institute (NAPRI) Zaria, Kaduna State, Nigeria. The chicks were weighed and randomly assigned into five groups of 45 birds which were subdivided into three replicates per group in a Completely Randomized Design (CRD). Feed and water were provided *ad libitum* during the trial period which lasted for 56 days. Weighing of birds was done at the beginning of the trial and weekly thereafter. Parameters taken were weight gain, feed intake, left over feeds were measured and recorded, feed conversion ratio and feed cost per kilogramme gain were calculated and mortality rate were recorded. Five isonitrogenous and isocaloric diets (23.17 % CP; 2831 Kcal/kg ME) and (21.73 % CP; 2929 Kcal/kg) for the broiler starter and finisher phases, respectively were formulated as follows:

Diet 1: Contained maize as main energy

Diet 2: Contained sorghum as main energy

Diet 3: Contained millet as main energy

Diet 4: Contained cassava as main energy

Diet 5: Contained sweet potatoes as main energy.

The main energy sources were used as diets to feed the experimental groups T₁, T₂, T₃, T₄ and T₅, respectively (Table 1 and 2). All diets were formulated to meet nutrient requirement standards of broilers (NRC, 1994).

Haematological parameters

Six birds were randomly chosen from each group and 2ml of blood was collected from each of them *via* the wing vein and put into a

sample bottle containing anti-coagulant (Ethylene Di-amine Tetra Acetic Acid - EDTA). The stored blood sample was analyzed for packed cell volume (PCV), Haemoglobin level (HB) and total protein (TP) according to procedures described by Lamb (1991) at the haematological laboratory of Veterinary Teaching Hospital, Ahmadu Bello University, Zaria. **Statistical analysis**

All data were subjected to Analysis of Variance (ANOVA) using the General Linear Model of SAS (2002). Significant differences between treatment means were separated using Duncan's Multiple Range Test of the SAS package.

Results and discussion

Table 1 shows the growth characteristics of broiler starter chicks fed diets containing different energy sources. Dietary treatment had significant ($P < 0.05$) effects on final weight, weight gain, feed intake, feed gain ratio, feed cost/kg gain, water intake, water: feed ratio and mortality. It was observed from this present study that chicks fed millet as main energy (T₃) had significantly ($p < 0.05$) the best result in terms of final weight, weight gain, feed intake and feed conversion ratio. Chicks fed sweet potatoes as main energy had significantly ($P < 0.05$) the highest feed cost per/kg gain. Chicks fed maize had the highest water intake. Mortality rate was higher in chicks fed sweet potatoes as main energy compared to other treatments. The differences in final weight, weight gain, feed intake, feed to gain ratio and water intake of birds fed millet diets might be due to more balanced nutrient combination in millets since required amount of the essential amino acids is necessary for protein synthesis which results in increased weight gain. This agreed with the reports of Rooney (1990) that millets contain more balanced amino acids than other common cereal grains which may enhance growth performance.

Table 1: Performance characteristics of broiler chicks fed different energy sources (0-4 weeks)

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅	
Initial weight (g/bird)	49.6±2.7	49.9±2.7	49.8±2.7	49.7±2.5	50.0±2.4	NS
Final Weight (g/bird)	420.2±27.1 ^b	445.7±24.3 ^b	503.4±21.2 ^a	251.7±20.6 ^c	285.4±18.7 ^c	*
Weight gain (g/bird)	370.6±16.4 ^b	383.7±15.0 ^b	453.6±17.5 ^a	201.9±16.0 ^c	235.4±15.9 ^c	*
Feed Intake (g/bird)	676.7±32.0 ^b	735.8±31.1 ^b	819.6±30.9 ^a	545.4±28.7 ^c	759.5±30.4 ^{ab}	*
Feed/conversion ratio	1.9±0.8 ^a	1.9±0.8 ^a	1.8±0.6 ^a	2.7±1.0 ^b	3.3±1.2 ^c	*
Feed cost/kg gain	168.5±8.3 ^a	177.4±8.1 ^{ab}	173.3±8.7 ^a	266.41±8.2 ^b	311.3±7.8 ^c	*
Water Intake (mls/bird)	1387.3±50.4 ^a	1350.4±55.2 ^a	1376.1±52.9 ^a	1265.2±53.9 ^b	1274.2±50.1 ^b	*
Water: Feed ratio	2.05±1.1 ^b	1.84±1.3 ^c	1.68±0.8 ^d	2.32±1.3 ^a	1.68±0.9 ^d	*
Mortality Rate (%)	0.70±0.2 ^c	0.16±0.7 ^a	0.20±0.9 ^b	0.16±0.6 ^a	3.30±1.2 ^d	*

^{abc}Means in the same row with different superscript are significantly different.

Table 2 shows the performance characteristics of broiler finisher chickens fed diets with different energy sources. Dietary treatments had significant ($P<0.05$) effects on final weight, weight gain, feed intake, feed conversion ratio, feed cost/kg gain, water: feed ratio and mortality rate. Chickens fed millet as main energy (T₃) has significantly ($P<0.05$) the best values for final weight, weight gain, feed intake, feed cost/kg gain. Millet fed chickens (T₃) had the best feed conversion ratio (1.62) as compared to other treatments while cassava fed chickens (T₄) consumed more water (3918.30mLs/b) compared to birds in other dietary treatments. This is an indication that millet contains more essential nutrients as compared to other cereals used in this study. This confirmed the observation of Adeola

(2006) that pearl millet contains 27 to 32% more protein than maize with higher concentration of essential amino acids. Highest feed intake observed in the treatments fed sorghum and millet was attributed to increase feed palatability as both sorghum and millet have been reported to enhance palatability (Amini and RuizFeria, 2007). Rao *et al.* (2001) observed significantly higher feed intake when broiler chicks were fed millet based diets. The steady decline in body weight gain of the broilers fed cassava as a source of energy may be attributed to the concomitant reduction in feed intake with increase in the inclusion levels of cassava peels. The reduction in feed intake may be associated with the residual cyanide which is inherent in cassava peels.

Table 2: Performance characteristics of broiler finisher chicken fed different energy sources (5 -8 weeks)

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅	
Initial weight (g/bird)	510.5±26.4	510.6±27.1	510.7±25.9	510.7±26.0	510.8±26.2	NS
Final Weight (g/bird)	2087.1±66.6 ^{ab}	2130.9±69.1 ^b	2302.7±60.8 ^a	1681.1±68.4 ^c	1711.1±59.9 ^c	*
Weight gain (g/bird)	1576.5±25.9 ^b	1620.3±24.8 ^b	1892.0±26.2 ^a	1170.4±26.8 ^c	1200.3±25.7 ^c	*
Feed Intake (g/bird)	2984.8±1.7 ^b	3019.7±1.4 ^a	3073.7±1.9 ^a	2515.2±1.6 ^d	2739.4±1.4 ^c	*
Feed/gain ratio	1.9±0.3 ^b	1.9±0.3 ^b	1.6±0.1 ^a	2.2±0.9 ^c	2.3±0.11 ^d	*
Feed cost/kg gain	167.7±9.6 ^b	162.4±10.1 ^b	145.9±9.2 ^a	197.2±9.7 ^c	204.4±10.6 ^c	*
Water Intake (mLs/bird)	3846.2±1.2 ^c	3886.6±1.7 ^c	3905.3±1.5 ^b	3918.3±1.3 ^a	3875.2±1.9 ^d	*
Water: Feed ratio	1.3±0.1 ^a	1.3±0.2 ^a	1.3±0.1 ^a	1.6±0.9 ^c	1.4±0.6 ^b	*
Mortality Rate (%)	2.2±0.8 ^b	4.4±1.3 ^c	6.7±1.0 ^d	0.00±0.0 ^a	0.00±0.0 ^a	*

^{abc}Means in the same row with different superscript are significantly different. SEM= standard error of means.

Table 3 shows the haematological parameters of broiler chicken fed different energy sources. Pack cell volume, total protein and haemoglobin were not

significantly ($P>0.05$) affected by the different energy sources with the exception of white and red blood cells. The values obtained in this study for Hb, PCV and TP

were similar to 6 – 13.0 %, 29.0 – 38.0 % reported by Iheukwumere and Herbert (2003) for Hb and PCV, respectively. This

implied that the feedstuff did not pose adverse effects on the health status of the birds.

Table 3: Haematological parameters of broiler finisher chickens fed different energy sources (5 -8 weeks)

	T ₁	T ₂	T ₃	T ₄	T ₅	LOS
Parameters	Maize	Sorghum	Millet	Cassava	Sweet potatoes	
PCV (%)	30.7±2.8	26.3±2.2	29.0±3.1	25.7±2.5	25.7±2.7	NS
Hb (g/dl)	10.2±2.1	9.3±1.8	9.6±2.7	8.5±2.2	8.5±2.0	NS
T.P (g/dl)	2.7±0.3	3.3±0.5	3.1±0.6	3.4±0.9	2.9±0.8	NS
WBC (10 ³ /ml)	2.9±1.6 ^b	4.2±1.3 ^a	3.9±1.1 ^a	1.8±1.5 ^c	2.3±1.3 ^b	*
RBC (10 ⁶ /ml)	3.8±0.5 ^a	4.8±0.3 ^a	5.0±0.8 ^a	1.5±1.2 ^b	2.6±1.1 ^a	*

Hb-Haemoglobin, TP-Total protein, PCV-Pack cell volume, WBC-White blood cell, RBC-Red blood cell, NS-Not significant

Conclusion

The following conclusion and recommendations could be drawn from this study; Millet based diet was determined to be the best with reduced cost of production without compromising productivity in broiler chickens. Energy sources influenced growth characteristics. White and Red blood cells varied within dietary groups. It is also recommended that other methods of processing millet should be exploited and studied within the same environment to evaluate the overall suitability of millet as an unconventional feed ingredient in poultry nutrition.

Conflict of interest

The authors have not declared any conflict of interest.

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