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Short Communication

Comparative evaluation of different energy sources in broiler diets

Authors:
Jirgi DJ[1] and Abeke FO[2]

Institution:
1. Federal Ministry of Agriculture and Rural Development, P.M.B 135 FCT Garki, Abuja. Nigeria.

2. National Animal Production Research Institute, Shika Zaria, Kaduna State. Nigeria.

Corresponding author:
Jirgi DJ

ABSTRACT:

This study was aimed at evaluating the nutritive value of different sources of energy in broiler diets on the growth performance and haematological parameters of broiler chickens. Five isonitrogenous and isocaloric diets for the broiler starter (0-4 weeks) and finisher phase (5-8 weeks) respectively were formulated. Treatment 1 is a control diet while treatments 2, 3, 4 and 5 were sorghum, pearl millet, cassava and sweet potatoes based diets respectively. A total of 225 day- old NAPRI X broiler chicks were randomly allotted to the five treatments in three replicates in a Completely Randomized Design (CRD). Data collected were analysed using the general linear model procedures of S.A.S. 9.0. Significant differences ($P<0.05$) in means among the dietary treatments were separated using a Tukey test. 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 (T_3) respectively than other treatments for both starter and finisher phase, respectively. T_3 (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) for finisher phase. Those fed the control (maize based diet (T_1) and sorghum (T_2) based diet gave similar ($P>0.05$) values as those fed T_3 (millet based diets). Birds fed diet T_5 (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 ($P<0.05$) in white and red blood cells. Millet based diet was determined to be the best with reduced 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.

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INTRODUCTION

Animal agriculture in developing countries such as Nigeria are confronted with various challenges. These problems include feed shortage, high prices of feedstuffs and climate variations (Belewu and Ojo-Alokomaro, 2007). Protein and energy are the most costly components in poultry diets, especially the plant protein (Mukhtar *et al*., 2015). The effects of these challenges have reflection on the quality and quantity of animal protein available for human consumption (Agbabiaka, 2012) 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 difference 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

Animal procured farm National Animal Production Research Institute (NAPRI) Zaria, Kaduna State, Nigeria were used in this study. A total of two hundred and twenty five (225) day-old broiler chicks (mixed sexes) were used. 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 kilogram gain were calculated and mortality rate were recorded. Five diets for the broiler starter and finisher phases respectively were formulated following Jirgi *et al*. (2016).

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 T_1, T_2, T_3, T_4 and T_5

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

S. No	Parameters	T_1	T_2	T_3	T_4	T_5	LOS
		Maize	Sorghum	Millet	Cassava	Sweet potatoes	
1	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
2	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}	*
3	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}	*
4	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}	*
5	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}	*
6	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}	*
7	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}	*
8	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}	*
9	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. SEM=standard error of means

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

S. No	Parameters	T_1	T_2	T_3	T_4	T_5	LOS
		Maize	Sorghum	Millet	Cassava	Sweet potatoes	
1	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
2	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}	*
3	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}	*
4	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}	*
5	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}	*
6	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}	*
7	Water intake (mls/bird)	3846.2±1.2^{e}	3886.6±1.7^{c}	3905.3±1.5^{b}	3918.3±1.3^{a}	3875.2±1.9^{d}	*
8	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}	*
9	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

respectively. All diets were formulated to meet nutrient requirement standards of broilers (NRC, 1994).

Hematological parameters

Six birds were randomly chosen from each group and 2ml of blood was collected from each of them *via* the wing vein in a sample bottle containing anti-coagulant (EDTA). It was then 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 generated were subjected to Analysis of Variance (ANOVA) using the SAS package, (2002), General Linear Model. Significant differences between treatment means were separated using Duncan Multiple Range.

RESULTS AND DISCUSSION

Table 1 showed 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 (T_3) 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

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

S. No	Parameters	T_1	T_2	T_3	T_4	T_5	LOS
		Maize	Sorghum	Millet	Cassava	Sweet potatoes	
1	PCV (%)	30.7±2.8	26.3±2.2	29.0±3.1	25.7±2.5	25.7±2.7	NS
2	Hb (g/dl)	10.2±2.1	9.3±1.8	9.6±2.7	8.5±2.2	8.5±2.0	NS
3	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
4	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}	*
5	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}	*

SEM= standard error of means; Hb-Haemoglobin; TP-Total protein; PCV-Pack cell volume; WBC-White blood cell; RBC-Red blood cell; NS-Not significant

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 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 (T_3) has significantly ($P<0.05$) the best values for final weight, weight gain, feed intake, feed cost/kg gain. Millet fed chickens (T_3) had the best feed conversion ratio (1.62) as compared to other treatments while cassava fed chickens (T_4) consumed more water (3918.30ml/b) compared to birds in other dietary treatments. This is an indication that millet contains more essential nutrients as compared to cereals used in this study. This is confirmed by the observation of Adeola (2006) who reported 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. This corroborates the findings of Rao *et al*. (2001) who 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 3 depicts 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 are in harmony with the reports of Iheukwumere and Herbert (2003) whose values were within 6 – 13.0 %, 29.0 – 38.0 % for Hb and PCV respectively. This implies that the feedstuff did not pose adverse effects on the health status of the birds.

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 had significant variation on growth characteristics. White and Red blood cells showed significant variations within the 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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