UTILIZATION OF WHOLE SWEET POTATO TUBER FLOUR AS BLOOD AND SEMEN GLUCOSE ENHANCER IN COMMERCIAL COCKS

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Abstract

Utilization of tuber crops as non-conventional feedstuffs in poultry nutrition has been the focus of some researchers in the tropics. However, there is little or no documentation on the influence of whole sweet potato tuber flour (WSPTF) on blood and semen glucose hence, this study was conducted. Twenty sexually matured commercial cocks at 13months old, weighing about 2.5kg were fed 0.0%, 10.0%, 15.0% and 20.0% WSPTF for eight weeks. Serum biochemical indices and semen quality were examined and the results indicated that triglyceride, cholesterol and creatinine levels varied from 0.08±0.03 to 2.13±0.24g/dl, 1.67±0.05 to 2.43±0.08g/dl and 44.1±0.04 to 44.2±0.03g/dl in that order. It was observed that blood and semen glucose levels were seemingly enhanced by the test ingredient. The sperm cells count value which ranged from 117.2±4.53 X 10^6 (T_3) to 154.7±9.79 X 10^6 (T_2) was not dependent on the testis weight which was highest (13.1±1.73g) in T_1 (0.0%WSPTF) treatment and lowest (7.9±1.0g) in T_4 (20.0% WSPTF). Even if the parameters evaluated were somewhat distorted, it was in an irregular trend and there was no evidence of adverse physiological effect of the test ingredient on the cocks. Thus, WSPTF may be used as a supplement in diets meant for cocks, to boost glucose bioavailability in the system, in order to improve the reproductive performance.

Keywords: Caloric value, glucose, serum biochemistry, semen quality.

Introduction

Poultry birds have the potentials to provide animal protein need of Nigerians due to their ability to convert feed into meat or eggs within a short time. However, the total poultry population in Nigeria is about 165million, of which larger percentage is reared under free range and semi intensive systems with their attendant demerits. Hence, the wider gap between chicken availability and requirement by over 170million Nigerians. This perhaps prompted the suggestion of Yakubu *et al.* (2010) that the quickest way to bridge the protein supply and demand gap, lies on the production of highly prolific animals. Such as poultry birds that are efficient feed converters to flesh, have short generation interval and the products are cherished by many people.

According to Ojewola and Ozuo (2006), cocks are good sources of meat in Nigeria and command high demand due to the special flavour and toughness. Poultry birds require proper nutrition for growth and reproductive performance, but the sources are mainly grains and cereals. Thus, tubers may be used as supplement or sole ingredient to replace energy source in poultry nutrition. Sweet potato tuber and foliage have been evaluated at varying levels as feed for poultry birds (Ravindran and Sivakanesan, 1996; Tewe, 1996; Woolfe, 1992). Energy ingredients are metabolized into several biochemical compounds such as carbohydrates. The carbohydrates further undergo series of biochemical pathways, yielding glucose among other products required for cellular activities. If there are antinutritional factors in the system, there might be distortion in the synthetic pathways that may obstruct glucose bioavailability. In such condition, histamine may be released and mask the cell binding site for glucose resulting in blood glucose upsurge. Since energy ingredients will provide glucose that sperm cells will depend on in the semen before syngamy, the presence of normal glucose levels in the blood and semen may be an indication of bioavailability for the animal to thrive well. Yet, there is little or no information on whole sweet potato tuber flour (WSPTF) as glucose enhancer in commercial cocks. Therefore, this study was designed to evaluate the potentials of WSPTF as blood and semen glucose booster in commercial cocks, as a new technology to enhance animal production in Nigeria.

Materials and Methods

Study location and experiment layout

The experiment was carried out at the Livestock Teaching and Research Farm, Nasarawa State University, Keffi, Shabu-Lafia Campus. Lafia is located in the Guinea savannah zone of north

central Nigeria on latitude 08°35'N and longitude 08°33'E with mean temperature of 27.61°C, relative humidity of 74% as well as annual rainfall of 1,168.9mm (NIMET, 2014).

A total of twenty commercial cocks weighing 2 – 2.5kg at 10months of age were procured from a commercial farm in Auta Balaifi near Abuja but were kept for 3months to attain full sexual maturity at 13months. They were randomly assigned to four experimental treatments such that each treatment had five cocks with a bird per replicate in a completely randomized design. The treatments were designated as T_1 (0.0% WSPTF), T_2 (10.0% WSPTF), T_3 (15.0% WSPTF) and T_4 (20.0% WSPTF) respectively.

Experimental diets and animal welfare

Fresh whole sweet potato tubers were bought at Lafia Central Market, sorted, washed, chopped, sundried and ground with the rind intact into coarse flour. A total of 800g of commercial grower mash (Supreme brand®) was offered to each treatment daily. But at the point of feeding, 0.0g (representing 0.0%), 80g (representing 10.0%), 120g (representing 15.0%) and 160g (representing 20.0%) of the 800g/day in T_1, T_2, T_3 and T_4were replaced with the ground whole sweet potato tuber flour (WSPTF). That is, T_1: 800g commercial feed + 0.0g WSPTF, T_2: 720g commercial feed + 80g WSPTF, T_3: 680g commercial feed + 120g WSPTF and T_4: 640g commercial feed + 160g WSPTF. These experimental diets and clean drinking water were offered to the animals *ad libitum*.

The birds were reared in deep litter pens which were regularly cleaned to maintain good hygiene. The birds were acclimatized for 3months in order to attain full sexual maturity. Antibiotics, antistress and dewormer were administered to ensure good health before the commencement of the experiment.

Data collection and analysis

At the end of the feeding trial that lasted eight weeks, a teaser (live hen) was introduced into the pens and a cock that attempted to mount was picked and semen was collected easily. Capillary tubes were used in collecting the semen which were quickly taken to the laboratory and processed for quality evaluation as described by Ogunlade (2015).

Later, all the birds were sacrificed and blood samples were collected immediately after severing the jugular vein. The blood samples were collected in bottles containing ethylene diamine tetra acetic acid and were processed for serum biochemical determination as prescribed by Campbell (1995). Thereafter, the abdomen was cut open and the testes were carefully collected and weighed using sensitive weighing balance. The paired testes value was divided by to obtain mean testis value. The blood and semen glucose levels were determined according to Goodwin *et al.* (1994). All the data collected were subjected to analysis of variance according to SPSS (2010) procedure and the mean values were separated using least significant procedure of the same software package.

Results and Discussion

The influence of whole sweet potato tuber flour on serum biochemical indices of commercial cocks is given in Table 1. There were significant differences ($P<0.05$) among the treatments in all the parameters investigated except creatinine. Triglyceride and alkaline phosphatase values were highest in T_1 (0.0% WSPTF) while, cholesterol, blood glucose and alanine aminotransferase values were highest in T_3 (15.0% WSPTF). The mean values of triglyceride varied from 0.8±0.03 to 2.13±0.24g/dl, cholesterol (1.67±0.05 to 2.43±0.08g/dl) and creatinine value ranged from 44.1±0.04 to 44.2±0.03g/dl. Blood glucose level ranged from 11.4±0.34 to 14.1±0.42g/dl, alkaline phosphatase value was between 1.07±0.14 and 3.09± 0.63i.u/l while alanine aminotransferase values varied from 1.75±0.24 to 4.0±0.72i.u/l. All these values were observed to be within the ranges given by Duwa *et al.* (2012) and Kwari *et al.* (2010) when cockerels were fed Sorrel seed meal.

It was observed that blood glucose was seemingly enhanced by the WSPTF in the treated cocks though not in a linear trend. The creatinine value that was uniform across the treatments as well as the alkaline phosphatase that was highest in control treatment may be an indication of no adverse physiological response of the cocks.

However, there was an upsurge in alanine amino transferase in cocks offered 15.0% WSPTF. The cause of this is not clear, but it may have been due to blood cholesterol, glucose and creatinine superior values recorded. Thus, cellular activities particularly steroid hormone synthesis may be enhanced in the cocks for better reproductive performance.

The effect of whole sweet potato tuber flour on semen quality of commercial cocks is provided in Table 2. There were significant differences ($P<0.05$) in all the parameters investigated except semen glucose. Testis weight and live sperm cells values were highest in control treatment whereas, the sperm cells count value was highest in cocks offered 10.0% WSPTF. The testis weight varied from 7.9±1.0 to 13.1±1.73g, semen glucose value

was highest (150.0±0.71g/dl) in T_2 compared to 149.4±0.68g/dl recorded in T_1. While live sperm cell value was lowest (71.6±5.1%) in T_3 it was as high as 94.4±1.5% in T_1 and sperm cells count value was highest (154.7±9.79 x 10^6) in T_2.

It was observed that none of the parameter values followed a definite trend among the treatments. Therefore, it is probably not the whole sweet potato tuber flour that affected the cock testis weight and semen quality. More so, the live sperm cells recorded was similar to 79 – 91% reported by Ogunlade (2015) in breeder cocks but the sperm cells count was greater than the values (33.0 – 39.5 x 10^6) reported. However, the observed sperm cells count was less than 4.21±1.45 x 10^9 reported by Peters *et al.* (2008) in naked neck cock. On the other hand, the testis weight and semen quality values were within the values reported by Tandondjou *et al.* (2013) in local chickens. More significantly, the sperm cells count was not dependent on the testis size thus contradicting the report of Bath and Chaudhari (2002) that size of the testis correlated significantly with the sperm reserve in Nigerian local cocks.

Conclusion

From the results, it was revealed that the blood and semen glucose levels were apparently affected suggesting possibly glucose bioavailability in the animal system if fed diets containing up to 20% WSPTF. Similarly, the blood cholesterol, and alkaline aminotransferase levels were seemingly influenced by the test diet. Although, the live sperm cells and sperm cells count were seemingly distorted in an irregular trend. There was no obvious evidence of WSPTF elicited adverse physiological response in the cocks. Consequently, whole sweet potato tuber flour may be used as high caloric feedstuff to enhance glucose bioavailability in order to improve cock reproductive performance.

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Table 1: Influence of sweet potato tuber on serum biochemistry of commercial cocks

Parameters	Treatments(±SEM)			
	T_1	T_2	T_3	T_4
Triglyceride (g/dl)	2.13±0.24^a	0.8±0.03^c	1.13±0.03^b	0.8±0.03^c
Cholesterol (g/dl)	1.67±0.05^b	1.67±0.05^b	2.43±0.08^a	1.87±0.05^b
Creatinine (g/dl)	44.1±0.04	44.1±0.04	44.2±0.03	44.1±0.04
Blood glucose (g/dl)	11.4±0.34^b	11.5±0.66^b	14.1±0.42^a	12.6±0.78^b
Alkaline phosphatase (i.u/l)	3.09±0.63^a	2.33±0.46^b	2.56±0.8^b	1.07±0.14^c
Alkaline aminotransferase (i.u/l)	1.75±0.24^c	2.49±0.86^b	4.0±0.72^a	2.18±0.68^b

$^{a, b, c}$: Mean values on the same row with different superscripts differ significantly at 5.0%; ^{SEM}: Standard error of mean.

Table 2: Effect of sweet potato tuber flour on semen quality of commercial cocks

Parameters	Treatments(±SEM)			
	T_1	T_2	T_3	T_4
Testis weight(g)	13.1±1.73^a	9.2±1.78^b	9.1±0.86^b	7.9±1.0^c
Semen glucose (g/dl)	149.4±0.68	150.0±0.71	149.8±0.58	149.6±0.81
Live sperm cells (%)	94.4±1.5^a	84.8±.86^b	71.6±5.1^c	84.2±3.17^b
Sperm cells count ($X10^6$)	140.98±4.99^b	154.7±9.79^a	117.2±4.53^d	127.6±8.13^c

$^{a, b, c}$: Mean values on the same row with different superscripts differ significantly at 5.0%; ^{SEM}: Standard error of mean.