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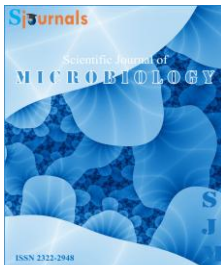

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Original article

Haematological and serum biochemistry response of finisher broiler fed graded levels of sweet potato (*Ipomoea batata*) meal as replacement for yellow maize

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ABSTRACT

The study was conducted to find out the haematological and biochemistry response of broiler finisher birds fed different levels of sweet potato meal (SPM). The levels of sweet potato meal in the different treatment diets were 0, 25, 50, 75%, respectively. The increase in PCV, HGB, and RBC contents of the blood of birds fed the experimental diets indicated an improved oxygen carrying capacity of the cells, which translated to a better availability of nutrients to the birds consequently affecting their well-being. SPM caused reduction in the levels of serum cholesterol, a very positive observation especially now that people are very conscious of reducing cholesterol content of animal protein and some people rejecting red meat. All haematological parameters assessed only reveal minor statistical (P>0.05) differences, falling within the ranges stated in literature for broiler birds. It is concluded that sweet potato root meal can replace maize meal in the diet of broilers which may be compensated by the lower cost of the sweet potato meal. The substitution also did not have any deleterious effect on haematological and serum biochemistry and by extension, the health status of the birds.

1. Introduction

An increase in the price of grains and the cost of producing poultry meat and eggs increased significantly resulting in a decreased ability of some of the world's population to purchase and consume chicken meat (Aho, 2007). In order to compensate for this change, alternative feed ingredients must be identified (Agwunobi, 1999). The alternative ingredients must be able to replace maize either totally or partially and must not have a deleterious effect on the efficiency of broilers; that is, it must not reduce feed efficiency, dressing percentage, and must produce a product of the same or superior quality (Ojewola et al., 2006). Several studies have evaluated the use of possible alternative feed ingredients; however, more extensive feed trials must be done in order to meet the requirements set forth by the National Research Council. One possible alternative is sweet potato (*Ipomoea batatas* L. [Lam]). It is a root crop produced in most countries and is consumed mainly as a starch source in the diet of humans but is also rich in other important nutrients (Dominguez, 2010). Both roots and tops apart from being used fresh, sweet potatoes could be made into a dried meal and fermented silage and fed to livestock, including pigs, cattle and poultry. This use is quite significant in China, the USA, Taiwan and India (Scott, 1992).

A strong justification for carrying out haematological and biochemical evaluation is the fact that sweet potato contains antinutritional factors like oxalates, trypsin inhibitors, "-solanine and a host of others, which can possibly precipitate anaemia and compromise the health status (Zhang and Corke, 2001; Antia et al., 2006; Kiran and Padamaja, 2003; Shen, 1997). The aim of this study was to investigate the effect of replacing maize with Sweet potato meal (SPM) in broiler finisher diets on haematological parameters and serum biochemistry with a view to determining the safest and most profitable levels of substitution of maize with SPM.

2. Materials and methods

2.1. Experimental location

The study was conducted for a period of 28 days at the Department of Agricultural Education Teaching and Research Farm, Federal College of Education [Tech] Bichi, Kano State Nigeria. The farm is located within the college at about 40km west of Kano city in Bichi Local Government area of Kano State within longitude 8 ^{0}E and 9 ^{0}E and latitude 12 ^{0}N and 13 ^{0}N in the semi-arid zone of North-western Nigeria. The area has two distinct seasons, a wet season (May – September) and dry season (October - April) with annual rainfall of 787mm and 980mm. KNARDA (2001).

2.2. Experimental birds and their management

One hundred and eighty four weeks old broiler chicks were allocated to four (4) treatment groups in a Complete Randomized Design (CRD). Forty five (45) birds were allotted to each diet, fifteen (15) birds per replicate. The birds were randomly selected and then weighed at the start of the experiment, each week thereafter and lastly, at the end of the study. This was done at the same time and day of the week. Sweet potato tubers were bought, washed and sliced into small chips and dried under the sun for a period of four days. The chips were then milled using a forage chopping and milling machine. The four experimental diets were formulated for broiler finisher to replace maize at 0, 25, 50, and 75% respectively. The diets formulated were balanced according to recommendations by NRC (1994). The formulated ration is presented in table 1, for the finisher period.

2.3. Blood Collection

Blood was collected on the 28th day of the experiment by jugular vein into sterile tubes containing an anticoagulant (EDTA) for the determination of hematological parameters like Packed cell volume (PCV) which was determined by the microhaematocrit method. Haemoglobin concentration was photometrically determined at the wavelength of 540nm; erythrocyte (RBC) and leucocytes (WBC) were done using the improved Neubauer haemocytometer. Differential leucocyte counts were determined by the thin slide method. Mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) were derived by calculation using formulae (Jain, 1993). The data were analyzed using analysis of variance (SAS, 2003). Where differences were observed, means were further separated using the Duncan's Multiple Range Test of the same software.

Table 1
Composition of broiler finishers diets containing sweet potatoes meal.

	Experimental Treatments			
	A	B	C	D
Ingredients (%)	0% SPM + 100% YM	25% SPM + 75% YM	50% SPM + 50% YM	75% SPM + 25% YM
Sweet potatoes meal	0	13.75	27.5	41.25
Yellow maize	55	41.25	27.5	13.75
Soya bean	25	25	25	25
Groundnut cake	15	15	15	15
Bone meal	4	4	4	4
Salt	0.25	0.25	0.25	0.25
Vitamin Premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated values				
CP (%)	20.61	19.83	19.06	18.27
CF (%)	4.32	4.26	4.32	4.30

Footnote: SPM = Sweet potatoes meal, YM= Yellow maize, CP = Crude protein, CF = Crude fibre.

3. Results and discussion

Haematological parameters table 2 showed significant differences ($P<0.05$) between treatments indicating that SPM influenced the values of the parameters. However, MCHC and ALT showed no significant differences ($P>0.05$) between the treatment groups. The experimental birds indicate that the values of WBC, RBC, and HGB had significant ($P<0.05$) treatment differences. This finding agrees with Iheukwumere et al. (2002) which reported significant differences ($P<0.05$) between treatments on haemoglobin (HGB) and Red blood corpuscles values. However, the RBC values for all treatments were within the normal range (Merk, 1979), but lower than the values reported by Ekenyem and Madubuike (2006) when broilers were fed varying dietary inclusion levels of *Ipomoea asarifolia* leaf meal . The result show that the more SPM was included in the feed the lower the value of RBC in birds fed treatment 4 diet.

The PCV was within normal range (Merk, 1979) and did not differ significantly ($P>0.05$) between treatments 1, 2, and 3. However, birds on treatment 4 had slightly lower PCV than the normal range. This implies that including SPM on diets of broilers had little or no effect on the relative quantity of blood cells as compared with the total volume of blood (Health and Olusanya, 1985). This report did not agree with Iheukwumere et al. (2002), which reported significant difference ($P<0.05$) in PCV arising from varying levels of feed restriction. However, the birds in the present research were not restricted from feeding. The increase in PCV, HGB, and RBC contents of the blood of birds fed the test ingredients is an indication of improved oxygen carrying capacity of the cells, which translated to a better availability of nutrients to the birds consequently affecting their well-being.

The haematological parameters assessed also showed significant difference ($P<0.05$) for mean corpuscular volume and mean corpuscular haemoglobin. The values reported for both parameters in birds fed treatment 4 diet was lower and differ ($P<0.05$) significantly when compared with that of treatments 1, 2 and 3. However, all parameters fell within the ranges stipulated in a Literature for domestic poultry (Schalm et al., 1975; Oyewale, 1987; Simarak's et al., 2004; Islam et al., 2004). This is a pointer to the fact that the replacement of maize by SPM did not predispose the birds to anaemia or any health threat.

Sweet potatoes meal (SPM) had significant ($p<0.05$) effect on most serum biochemical parameters measured (Table 3) except K, Cl and SGPT that was not significantly ($p>0.05$) affected. The kidney function variables such as urea and creatinine significantly ($P<0.05$) varied between treatment. Urea in treatment 2 differ ($p<0.05$) significantly and was higher than that observed in the control and treatment 4 which were higher than that in treatment 3. This trend also applied to creatinine in which treatment 3 differ ($p<0.05$) significantly when compared with other dietary treatments which were similar, implying a reduction in efficiency of the kidney function. This

affirms the report of Awosanya et al. (1999) who observed the dependence of blood protein and creatinine on the quality of dietary protein. Similar trend was observed for Na and cholesterol in treatments 2 and 3 which were similar and significantly ($p<0.05$) higher than that in treatments 1 and 4. SGOT in treatments 1, 2 and 4 were similar and significantly ($p<0.05$) higher than that of treatment 3 which differ ($p>0.05$) significantly. Iyayi (2001) while feeding swine with cassava leaf supplement found that SGOT and SGPT were significantly lowered which is not in agreement with the findings of this study. The result indicated that sweet potatoes in the diet of broiler chickens successfully reduced the cholesterol in the serum of birds fed treatment 2 and 3 diets. The present findings also reveal that the SPM caused reduction in the levels of serum cholesterol, though birds on control did not show any variation from treatment 4 where the cholesterol statistically increased. This observation is very positive especially now that people are very conscious of reducing cholesterol content of animal protein, which has made some people reject red meat.

Table 2
Haematological parameters of broilers fed sweet potatoes diet.

	Treatments					
Parameters	**1**	**2**	**3**	**4**	**SEM**	**P value**
WBC ($x10^3$ml)	260.97^a	260.47^a	273.97^a	174.67^b	44.5	0.05
RBC ($x10^6$ml)	2.18^a	2.20^a	2.48^a	1.46^b	0.43	0.02
HGB (g/dl)	9.67^a	8.87^a	10.13^a	5.90^b	1.96	0.05
PCV (%)	29.50^a	28.83^a	32.23^a	19.43^b	5.62	0.03
MCV (fl)	135.93^a	130.97^a	130.07^a	88.57^b	22.39	0.001
MCH (pg)	43.30^a	40.27^a	40.87^a	26.90^b	6.92	0.01
MCHC (g/dl)	31.90	30.77	31.40	20.23	5.20	0.19
ALT	0.00	2.00	0.00	2.67	1.54	0.65

SEM: Standard error of mean $^{a.b,\ c}$ Means on the row with different superscripts are significantly ($p<0.05$) different.

Table 3
Serum parameters of broilers fed sweet potatoes fed diet.

	Treatments					
Parameters	**1**	**2**	**3**	**4**	**SEM**	**P value**
Urea	1.63^b	2.70^a	1.23^c	1.80^b	0.76	0.02
Creatine	0.50^b	0.49^b	0.52^a	0.49^b	0.01	0.03
Na	121.67^b	154.67^a	142.33^a	132.33^b	8.25	0.01
K	4.67	4.57	5.03	5.43	0.72	0.82
Cl	73.67	60.67	60.00	62.00	13.04	0.86
SGOT	698.3^a	651.7^a	492.7^b	608.3^a	114.38	0.05
SGPT	2.64	2.63	2.91	2.63	0.13	0.42
Cholesterol	143.33^b	127.33^a	131.67^a	150.33^b	6.22	0.04

SEM: Standard error of mean $^{a.b,\ c}$ Means on the row with different superscripts are significantly ($p<0.05$) different.

4. Conclusion

The result of haematological and biochemistry of broiler finisher diets containing sweet potato meal (SPM) fed to broilers at finisher stage indicated that incorporation of sweet potato meal (SPM) up to 75% as replacement of yellow maize did not constitute health hazards to the birds.

This study recommends that sweet potato meal (SPM) could be incorporated into the broiler finisher diet up to 75% as replacement of yellow maize. However, further studies should be carried out in order to evaluate performance, digestibility and economic incorporation. Also the result of the experiment could be used to improve sweet potatoes production and job creation in Nigeria.

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