HAEMATOLOGIC AND CARCASS INDICES OF BROILER CHICKENS FED GRADED LEVELS OF SWEET POTATO (*Ipomoea batatas*) PEEL MEAL FORTIFIED WITH PALM OIL

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ABSTRACT

A 56 days trial was conducted to evaluate the effect of feeding graded level of sweet potato peels and palm oil on haematological indices and carcass characteristics of broiler chickens. A total of 144 day-old broiler chicks with average weight of 43g were randomly allotted into four iso-nitrogenous and iso-caloric dietary treatments, with four replicates of 9 birds each in a completely randomized design (CRD). The treatment combinations were; **A** (control without SPPM and palm oil) **B** (8% of SPPM and 1.5% palm oil), **C** (16% of SPPM and 1% palm oil) and **D** (24% of SPPM and 0.5% palm oil). The experimental diets and fresh drinking water were offered *ad libitum*. Data obtained from the response variables were subjected to analysis of variance (ANOVA) using statistical analysis system (SAS) package. The results of Haematological indices revealed significant ($p<0.05$) differences in Haemoglobin level (Hb), packed cells volume (PVC), White blood cells (WBC), and Mean corpuscular hemoglobin concentration (MCHC). The carcass characteristics showed significant differences in liveweight, dressed weight, carcass yield, head, breast, and wings among treatments. Similarly, internal organ characteristics presented significant ($p<0.05$) differences for lungs, heart and liver. It was concluded that inclusion of a combination of 16% SPPM + 1.0% palm oil yielded haematologically healthier birds and is therefore recommended.

Key words: sweet potato peels meal, haematology, carcass characteristics, broiler chickens

INTRODUCTION

Nutrient is the most important consideration in any livestock enterprise. Its survival depends on the availability of feedstuff, which is a main component of human food. Esonu *et al*. (2005). However, it has been estimated that 70 to 80% of the total cost of production are attributed to feed cost, hence making it imperative that good quality feed be available at reasonable price to make broiler production more profitable, the potentials of the industry is affected by the high cost of feed especially energy and protein sources. The major source of energy is maize (Vantsawa, 2001; Afolayan *et al*., 2012). However, maize is required by humans and processing industries, thereby causing a tacit competition between humans and animals. Continual increase in prices of conventional feedstuffs has necessitated the search for alternatives to the expensive energy source (Afolayan *et al*., 2012*)*. The most strategic way to improve this is by use of feed ingredient that are inexpensive but nutritionally beneficial to poultry birds. One of such alternatives for replacement of maize in animal diets is the sundried sweet potatoes peel meal (SPPM). The relative availability and low cost of sweet potatoes peel make it an option in livestock feeding. Sweet potato is high in energy, moderate in protein and low in crude fibre. Abdel-Hafeez *et al*. (2018) found the values of crude protein and crude fibre to be 36-46g/kg and 38-70g/kg, respectively and a metabolisable energy of 2690 kcal ME/kg. In most studies carried out with sweet potato peel meal (SPPM) in poultry diets, there were general trends of depressing performance with increasing level of SPPM (Agwunobi, 1999; Maphosa *et al.,* 2003; Ayuk and Essien, 2009; Afolayan, 2010). The poor performances were associated with the anti-nutritional factors (ANFs) in the sweet potato. According to Aina and Fanimo (1997) sweet potato contains tannin, phytate, oxalate and trypsin inhibitors which may affect nutrient utilization and depress performance. The addition of palm oil has shown to improve diet texture and increase palatability, also the addition of palm oil has other benefits. Uchegbu *et al*. (2011) reported that there were added advantage in incorporating palm oil as it is a detoxification agent in partial substitution for maize with cassava root meal fortified with palm oil on performance of starter broiler chickens.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Bayero University, Kano. One hundred and forty-four (144) day-old

broiler chicks (Marshall Strain) were randomly allotted into four dietary treatments comprising of thirty-six chicks per treatment which was replicated four times with nine chicks per replicate in a completely randomized design. Four iso-caloric and iso-nitrogenous experimental diets were formulated and manufactured. The treatments were designated as A, B, C and D which contained different combinations of sweet potato peels meal (SPPM) and palm oil; **A** (control without SPPM and no palm oil), **B** (8% of SPPM and 1.5% palm oil), **C** (16% of SPPM and 1% palm oil) and **D** (24% of SPPM and 0.5% palm oil). The level of palm oil in these combinations decreased with increase in the level of SPPM due to its higher metabolizable energy content and meant to meet the energy requirement of the birds. The sweet potatoes peel was sourced within Kano metropolis, sun dried on a clean concrete floor. The dried sample was grounded using hammer mill, packed in a sack and stored at room temperature. Experimental diets and fresh drinking water were provided *ad libitum* throughout the duration of the experiment. Routine medication and vaccination were observed. The experiment lasted for eight weeks.

DATA COLLECTION AND STATISTICAL ANALYSIS

Haematological Indices

At the end of the finisher phase, one bird per replicate was selected on the basis of average pen weight from each treatment group and 2mls of blood sample 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) and then analyzed for packed cells volume (PCV), Haemoglobin level (Hb) and Total protein (TP), White blood cells (WBC) and Red blood cells (RBC) according to the methods described by Lamb (1991).

Carcass Measurements

At the end of the feeding trial, two birds per replicate, having representative weight of the group was taken, starved of feed overnight so as to allow for the emptying of the crop and excretion of the undigested feed residue. Each bird was weighed individually, slaughtered to drain the blood and reweighed. De-feathering followed by steaming them in hot water at 80^0C for 10 to 15 minutes as described by Hann and Splindler (2002). The prime cut up parts and visceral organs was weighed and recorded. The prime cuts such as shanks, head, breast, drumsticks, thighs, wings and neck was measured and recorded using electronic sensitive balance and expressed as percentage (%) of the dressed weight. The internal organs and other visceral components such as liver, gizzard, heart, crop and abdominal fat were removed from individual carcasses in all the treatment groups and weighed using electronic sensitive balance and expressed as percentage of live weight.

Statistical Analysis

At the end of the experiments, data obtained from the response variables was subjected to analysis of variance (ANOVA) using statistical analysis system (SAS, 2002) where significant differences between the means detected were separated using least significant difference (LSD).

Table 1: Ingredient composition of the experimental diets for broiler finisher phase (5-8 weeks)

	Treatments			
Ingredients	A	B	C	D
Sweet potato peel meal	0.00	8.00	16.00	24.00
Palm oil	0.00	1.50	1.00	0.50
Maize	56.00	46.45	42.05	39.50
Soybean	25.05	26.10	27.00	27.05
Wheat offal	12.00	12.00	9.00	5.00
Fish meal	2.00	2.00	2.00	2.00
Limestone	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25

Lysine	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
ME (kcal/kg)	3002.00	3002.00	3003.00	3004.00
Crude protein (%)	20.00	20.00	20.00	20.00
Crude fibre (%)	4.50	4.70	5.30	6.00
Calcium (%)	1.49	1.50	1.54	1.43
Available phosphorus (%)	0.50	0.53	0.53	0.49
Lysine (%)	1.01	1.02	1.03	0.92
Methionine (%)	0.53	0.51	0.51	0.49

*Composition of Premix (Vitamin-mineral mixture): vitamin A: 2 400 000 IU; vitamin D: 1 000 000 IU; vitamin E: 16 000 IU; vitamin K: 800 mg; vitamin B1: 600 mg; vitamin B2: 1 600 mg; vitamin B6: 1 000 mg; vitamin B12: 6 mg; niacin: 8 000 mg; folic acid: 400 mg; pantothenic acid: 3 000 mg; biotin: 40 mg; antioxidant: 3000 mg; cobalt: 80 mg; copper: 2000 mg; iodine: 400; iron: 1 200 mg; manganese: 18 000 mg; selenium: 60 mg; zinc: 14 000 mg

RESULTS AND DISCUSSION

Haematological indices

Dietry treatments had no significant effect ($p > 0.05$) on the RBC, mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH). On the contrary, Hb, PCV, white blood cells (WBC) and MCHC differed significantly across the dietry treatment groups ($p < 0.05$). Values for PVC, MCHC and hemoglobin were significantly higher in broilers fed Diet B, and decreased with increasing levels of SPPM. The PCV was significantly ($p < 0.05$) lower in broilers fed diets C and D compared to birds fed the control diet. This was because all the values fell within normal range for mature broiler chickens as reported by Banerjee (2007), Muhammed and Oloyede (2009). The comparable WBC values suggest that the broilers were healthy because of the decrease in number of the WBC below the normal range is an indication of allergic condition and certain parasitism or presence of foreing body in circulating system (Ahamefule *et al.*, 2008).

Table 2. Hematological indices of broiler chickens fed diets containing graded levels of sweet potato peel meal and palm oil

	Treatments					
Parameters	A	B	C	D	SEM	*P*-value
Hb (g/dl)	14.95^{a}	15.33^{a}	14.19^{b}	$13.55^{c,b}$	0.26	*
PCV (%)	29.25^{a}	29.29^{b}	27.10^{a}	$27.27^{c,b}$	0.36	*
RBC (x 10^{12}/l)	2.13	2.20	2.11	2.06	0.03	NS
WBC (x 10^{9}/l)	2.54^{b}	2.24^{a}	2.44^{b}	2.89^{c}	0.08	*
MCV (fl)	137.63	124.02	138.25	131.95	2.39	NS
MCH (pg)	70.31	70.17	67.41	65.62	1.00	NS
MCHC (%)	51.11^{b}	56.15^{a}	48.77^{c}	49.70^{c}	1.09	*

*Hb: Hemoglobin, PCV: Packed cell volume, RBC: Red blood cell, WBC: White blood cell, MCV:Mean Corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration SME: Standad error of mean^{abcd}Means in the same row with different superscript are significantly different LOS: Level of significance NS: Not significant *Significant ($p < 0.01$).*

Carcass Characteristics

The carcass and internal organs characteristics of broiler chickens fed diets containing graded levels of sweet potato peel meal and palm oil are shown in Table 3. Live weight, dressed weight, carcass yeild, thigh, drumstick, head, shank, breast muscles and wing weights were significantly ($p < 0.01$) higher for broilers fed diet B compared to other treatment groups. The lowest value was recorded in birds fed diet D compared to control group and treatment B. Carcass yield as well as the yields of carcass cut up parts observed in the present study were all comparable to yields reported in literature

for broiler chickens (Oluyemi *et al.*, 2000, Jourdain, 1980, Jadhav and Siddiqui, 2010). The carcass yield, relative weight of pancreas tended to decrease as the level of SPPM and palm oil increased. This was not consistent with the study of Nwokoro and Ekhosuehi (2005) with graded levels of cassava peel in cockerel diet. The finding is in agreement with the results of Mafouo *et al.* (2011) that cassava meal supplemented with combination of palm oil and cocoa husk decreases the carcass yield with increased graded levels of cassava meal in broiler chickens.

For internal organs characteristics, the highest value of lung weight was observed in birds fed diet C and it differed significantly ($p < 0.05$) from treatments A and D but was similar ($p > 0.05$) to treatment B. Gizzard weight was significantly reduced in broilers fed diet B compared to other treatment groups. The same trend was observed for heart weight. Liver weight was significantly higher in broilers fed diet B compared to control group. Also, values decreased significantly ($p < 0.05$) in response to increased levels of SPPM in the diets. The opposite trend was observed for proventiculus, average weight was significantly reduced in broilers fed diet B compared to other treatments. Additionally, though values decreased in response to increased levels of SPPM and palm oil in diets, pairwaise comparison of experimental diets indicated a non-statistically significant difference ($p > 0.05$). Spleen weight of the birds was similar across the dietary treatments ($p > 0.05$).

Table 3. Carcass and internal organ characteristics of broiler chickens fed diets containing graded levels of sweet potato peel meal and palm oil

	Treatments					
Parameter	T_A	T_B	T_C	T_D	SEM	*P*-value
Live weight (g)	2105.38^{a} 2224.75^{b}	1972.83^{c}	1824.70^{d}	39.71	*	
Dressed weight (g)	1847.50^{a}	2004.75^{b}	1673.25^{c}	1527.75^{d}	46.42	*
Carcass weight (g)	1602.25^{a}	1666.50^{b}	1539.0^{c}	1477.75^{d}	18.44	*
Dressing %	76.05^{a}	74.93^{a}	78.02^{a,d}	81.05^{b,d}	0.70	*
Prime cut (% of DW)						
Head	63.20^{a}	70.75^{b}	45.55^{c}	44.00^{c}	3.05	*
Shank	87.47^{a}	93.85^{b}	85.72^{a}	74.50^{c}	1.93	*
Wings	156.75^{a,b,c}	166.0^{a}	153.8^{b,c}	151.8^{c}	1.84	*
Thighs	245.75^{a} 249.56^{a}	190.75^{b,d}	180.0^{c,d}	7.59	*	
Drumsticks	239.0^{a}	208.50^{b} 210.0^{b,c}	202.0^{b,d}	4.17	*	
Breast	461.50^{a} 477.18^{a,b}	343.50^{c}	323.25^{c,d}	15.49	*	
Internal organs (% of CW)						
Lung	17.55^{a}	18.61^{b}	19.25^{b,c}	15.76^{d}	0.36	*
Heart	11.18^{a}	10.11^{b}	11.75^{a}	10.98^{a,b}	0.19	*
Liver	35.52^{b} 44.55^{a}	36.65^{b}	33.88^{b,c}	1.14	*	
Spleen	1.63	1.61	1.75	1.90	0.12	NS
Gizzard	44.33^{b}	37.42^{c}	43.27^{b}	48.70^{a}	1.08	*
Proventriculus	15.13^{a}	9.75^{b,d}	11.18^{c,d}	11.65^{a,d}	0.64	*

*DW: Dressed weight, LW: Live weight, SME: Standad error of mean^{abcd}Means in the same row with different superscript are significantly different LOS: Level of significance, NS: Not significant *Significant ($p < 0.01$)*

CONCLUSION

It was concluded that inclusion of a combination of 16% SPPM + 1.0% palm oil yielded haematologically healthier birds and is therefore recommended.

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