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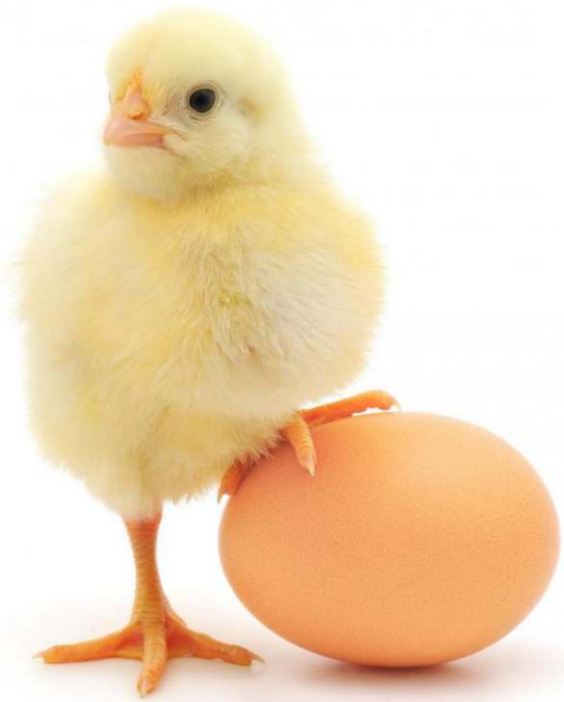

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Growth and Haematological Response of Broiler Chicks Fed Graded Levels of Sweet Potato (*Ipomoea batata*) Meal as Replacement for Maize

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Abstract: The study was conducted to find out the performance and haematological response of broiler birds fed different levels of sweet potato meal (SPM). The levels of sweet potato meal in the different treatment rations were 0, 10, 20, 30, 40 and 50%, respectively. There was a curvilinear decline in growth rate (from 27.9 to 23.3 g/day) as the maize was replaced by sweet potato root meal with a pronounced reduction in performance overall of 17% when all the maize was replaced by sweet potato meal. All haematological parameters assessed only showed minor numerical (P>0.05) differences, falling within the ranges stated in literature. It is concluded that sweet potato root meal can replace maize meal in the diet of broilers over the weight range 50 to 1400 g, with only a slight reduction in growth rate (17% with complete substitution of maize), 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 by extension, the health status of the birds.

Key words: Broilers, haematological response, growth rate, sweet potato meal

INTRODUCTION

One of the very important indices for measuring the degree of poverty (or prosperity) of a nation is the level/and quality of protein consumption of its citizenry. Low protein consumption(especially protein from animal sources) is a major hallmark of developing/emerging economies. The very wide gap between the annual consumption of animal products in industrialized and developing Countries is shown in Table 1.

Table 1: Actual and expected annual consumption of animal products from different species in kg per capita

	Industrialized countries		Developing countries	
	1993	2020	1993	2020
Beef	25	26	5	7
Pork	28	29	9	13
Poultry	20	25	5	8
Milk& dairy products	192	189	40	62

Source: IFPRI, 1999.

Oluyemi and Roberts (2000) posited that feed cost gulps the highest cost in animal production (70%-80%).This is a major challenge tot the bid of Nigeria and most developing countries in surmounting animal protein deficiency. A search for alternative, unconventional and cheaper feed ingredients like sweet potato, as a replacement for maize(a feed ingredient that occupies a very high wrung in both human and animal nutrition and has recently found a new use as a source of ethanol) is therefore necessary as it holds a great promise in increasing the protein consumption of peoples of the developing world.

Sweet potato is a member of the family *Convolvulaceae*, Genus *Ipomoea*, section *Batatas*. It is generally considered a high-energy food and is the staple crop of many parts of the world. The cost of production of sweet potato is much lower compared to cereal crops (Huarg, 1982). In English, it is simply referred to as sweet potato. In Spanish (batata, boniato or camote), in Yoruba (ananmo), hausa (dundun denkali), igbo (jiwanu) and the efiks, 'bia mbakara'.

The carbohydrates of sweet potato is highly available and can be greatly utilized by non-ruminant animals (Oboh, 1987). Also, patatin which accounts for 30-40% of protein in the potato tuber is extremely well balanced, being nutritionally similar to casein (Liedl *et al.*, 1987). The leaves of sweet potato are rich in carotenes, pro-vitamin A and calcium and are a valuable addition to the diet. In an experiment with sweet potato leaves sourced from Uyo in southeastern Nigeria, Antia *et al.*, (2006) discovered the mineral content of sweet potato leaves to be 340mg, 37.28mg, 28.44mg, 16.00mg, 4.33mg, 4.05mg and 0.08mg/100 for magnesium, phophorus, calcium, iron, sodium, manganese and zinc respectively Sweet potato varieties with dark orange flesh are richer in vitamin A than light fleshed varieties and their increased cultivation is being encouraged in Africa where vitamin A deficiency is a serious health problem Sweet potato is often considered a small farmer's crop. However, in African countries such as Burundi, Rwanda and Uganda, sweet potato is a staple food. According to FAO (1990), Per-capita production in Burundi is put at 130kg. In Africa, sweet potato is grown in abundance around upland lakes in the East African Rift valley (Uganda, Rwanda, Burundi, Tanzania, Kenya). It is also found in most African regions with large variations in relief (Cameroon, Guinea, Madagascar) or where the dry season is too marked for cassava growing like in the

Sudan-Sahelian fringe or in North Africa. In Nigeria, sweet potato is grown in Sokoto, Zamfara, Kebbi, Kaduna, Kano, Katsina, Gombe, Bauchi and parts of Plateau and Nassarawa states.

Sweet potato tubers are used for livestock feed in Taiwan and China where this root crop is classified among low ranking priority crops (Huarg, 1982). Over 95% of sweet potato is produced in developing countries (CGIAR, 2001). Asia is the world's largest producer of sweet potato with an annual production of 125 million tonnes, with China alone producing more than 117 million tonnes, representing 80% of the world's production. Africa accounts for about 15% of world production and the rest of the world about 5%. The US accounts for less than 1% of world production (Wanda, 1995: http://www.hort.purdue.edu/newcrop/ searcengine. html).

In July 2007, a ton of maize in Nigeria sold for N32,000. By December 2007, it sold for N45,000 and in February 2008, a ton of maize sold for N60,000. This galloping fluctuation of the price of maize has been with Nigeria for a long time. Since nutrition gulps more than 80% of the total cost of running any poultry enterprise (and infact, any animal enterprise), any effort or government policy that reduces the cost of feed inputs (like options that seek to provide viable alternatives to maize in poultry rations), would greatly boost poultry production and *ipso facto*, meat production in Nigeria (the exchange rate of the Naira to the dollar in the first quarter of 2008 was N120:00 to $1.). The general objective of this study therefore was to investigate the effect of replacing maize with Sweet potato meal (SPM) in broiler starter diets on performance and some haematological parameters with a view to determining the safest and most profitable levels of substitution of maize with SPM. A strong justification for carrying out haematological evaluation is the fact that sweet potato contains antinutritional factors like oxalates, trypsin inhibitors, α-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).

MATERIALS AND METHODS

The study was conducted for a period of 49 days at the Gregario Araneta University, Calocan City, The Philippines. One hundred and eighty day old broiler chicks were allocated to six (6) treatment groups in a Complete Randomized Design (CRD). The one hundred and eighty birds were randomly distributed to six treatment groups in three replicates. Thirty (30) birds were allotted to each ration, ten (10) birds per replicate. The birds were wing-banded for identification and then weighed individually 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. The yellow variety of sweet potato tubers were bought, washed and sliced into small chips and dried under the sun until they were brittle. The chips were then milled using a hammer mill. The six treatment rations (SW0 through SW50) were formulated to contain 0, 10, 20, 30, 40 and 50% sweet potato meal(SPM), respectively. Fish meal, soyabean (full fat), copra meal, rice bran, leucaena leaf meal, vitamin-mineral premix, bone meal and vegetable oil were the other ingredients in the treatment rations (Table 2). Feeding was *ad-libitum*.

Table 2: Composition of experimental diets (Dry basis)

	Treatments					
Ingredients	SW0	SW10	SW20	SW30	SW40	SW50
SPM	0.0	10.0	20.0	30.0	40.0	50.0
YM	50.0	40.0	30.0	20.0	10.0	0.0
FM	10.0	10.0	10.0	10.0	10.0	10.0
FFS	18.5	20.0	22.0	23.0	25.0	26.0
CM	11.0	10.0	9.0	8.0	7.0	6.0
RB	6.0	5.0	4.0	4.0	3.0	3.0
LCM	3.0	3.0	3.0	3.0	3.0	3.0
VMM	0.5	0.5	0.5	0.5	0.5	0.5
BM	1.0	1.0	1.0	1.0	1.0	1.0
VO	0.0	0.5	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

SPM = Sweet Potato; YC = Yellow corn; FM = Fishmeal; FFS = Full fat soyabean, CM = Copra meal; RB = Rice bran; LCM = Leucaena leaf meal; VMM = vitamin-mineral premix; BM bone meal; VO = vegetable oil.

Blood was collected on the 49th day of the experiment by jugular venipuncture into sterile tubes containing an anticoagulant (the disodium salt of ethelene diamine tetra acetic acid, 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 the following formulae:

$$MCHC = \frac{Hb\ (g/dl)}{PCV\ (\%)} \times 100$$

$$MCH = \frac{Hb\ (g/dl)}{RBC\ (\times 10^6 \mu l)} \times 10$$

$$MCV = \frac{PCV\ (\%)}{RBC\ (million/\mu l)} \times 10$$

Source: Jain, 1993.

The data were analyzed using analysis of variance (SAS, 1998). Where differences were observed, means were further separated using the Duncan's Multiple Range Test of the same software.

Table 3: Performance of broilers fed different levels of sweet potato meal

	Treatments					
	SW0	SW10	SW20	SW30	SW40	SW50
Live weight (g)						
Initial weight.	51.2	50.8	49.8	49.0	50.5	50.2
Final at 49days	1418	1393	1312	1355	1337	1192
Daily gain	27.9[a]	27.4[a]	25.8[a]	26.7[a]	26.3[a]	23.3[b]

[ab] Means in the same row without common letter differ at P < 0.05

Table 4: Haematological profile of birds fed different levels of Sweet Potato Meal as replacement for maize

	0% SPM	10% SPM	20% SPM	30% SPM	40% SPM	50% SPM
RBC ($x10^6$ml)	2.95±0.06	2.94±0.00	2.92±0.03	2.92±0.04	2.91±0.03	2.90±0.03
Hb (g/dl)	9.74±0.01	9.84±0.02	9.88±0.01	9.90±0.02	9.95±0.00	9.97±0.00
PCV (%)	27.25±0.06	28.55±0.04	28.23±0.04	27.27±0.06	28.77±0.05	28.23±0.04
MCHC (gm/dl)	35.74±0.04	34.47±0.02	34.99±0.06	36.30±0.02	34.43±0.01	33.58±0.02
MCH (pg)	33.02±0.01	33.47±0.01	33.84±0.00	33.90±0.00	34.19±0.00	34.38+0.01
MCV (fl)	9.24±0.01	9.71±0.00	9.67±0.00	9.33±0.01	9.89±0.01	9.73±0.01
WBC ($x10^3$ml)	9.31±0.00	9.45±0.00	9.40±0.01	9.41±0.02	9.42±0.01	9.44±0.01
Lymphocytes (%)	58.00±019	58.24±0.20	58.12±0.21	58.45±0.20	58.00+0.21	58.22+0.19
Monocytes (%)	5.00±0.00	5.00±0.00	5.00±0.00	5.00±0.01	5.00±0.00	5.00±0.00
Heterophils (%)	30.01±0.11	30.12±0.13	30.11±0.11	30.11±0.01	30.14±0.01	30.16±0.13
Eosinophils (%)	7.12±0.14	7.10±0.12	7.12±0.12	7.10+0.11	7.13+0.12	7.10+0.11
Basophils (%)	2.01±0.00	2.00±0.38	2.00±0.45	2.00±0.00	2.06±0.41	2.00±0.00

RESULTS AND DISCUSSION

Analysis of variance indicated no differences among sweet potato levels between 0 and 40% with a significant reduction at the 50% substitution (Table 3). Regression indicated that in fact there was a curvilinear decline in growth rate as the maize was replaced by sweet potato root meal (Fig. 1) with a pronounced reduction in performance overall of 17% when all the maize was replaced by sweet potato meal.

Tewe (2002), in an experiment to replace maize with oven-dried and sun-dried sweet potato meal(SPM), found out that there was a reduction in body weight gain and nutrient utilization of birds in the SPM substituted compared with the maize-based control diets. The slight but consistent reduction in growth rate as sweet potato root replaced maize may have been due to the presence of unidentified inhibitors of digestive and / or metabolic processes as suggested by Gerspacio (1978). The diets became increasingly dusty as the level of inclusion of sweet potato meal in the diets increased and this may have been another limiting factor. Sweet potatoes contain trypsin inhibitors, which may reduce ability to utilize protein if eaten raw (Collins, 1995).This drop in weight gain as the proportion of SPM increased in the diet prompted the investigation into the haematology of the birds, to determine if ! there were marked deviations from what is in literature by reason of the replacement of maize by SPM.

The blood constituents assessed revealed that none of the haematological parameters assessed showed any significant difference (P>0.05). 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 It is concluded that sweet potato root meal can replace maize meal in the diet of broilers over the weight range 50 to 1400 g, with only a slight reduction in growth rate (17% with complete substitution of maize) which, depending on local circumstances, is compensated by the lower cost of the sweet potato meal. With current advances in biotechnology, sweet potato root can be nutritionally enriched. Yang, 1998, Yang *et al.*, 1993 and Abu *et al.*, 2000 have respectively reported the protein enrichment of sweet potato by solid-state fermentation with amylolytic yeast and filamentous fungi.

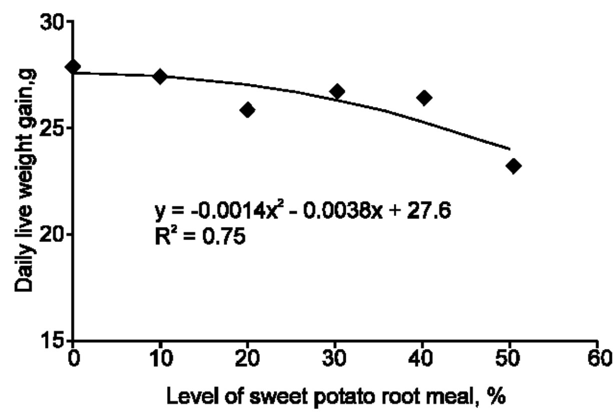

Fig .1: Relationship between replacement of maize meal by sweet potato root meal and growth rate in broilers over the weight range 50 to 1400 g live weight.

With the newfound use of cassava and maize and most conventional energy sources as biofuels, there is the serious threat of the prices of these energy sources sky rocketing, posing a serious threat to the livestock industry. A recourse to a low priory energy source like SPM is a way out of this problem.

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