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Original Article

Effect of Using Different Levels of Sweet Potato Tubers as a Source of Energy on Performance and Carcass Characteristics of Broiler Chicken

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ABSTRACT

An experiment had been carried out to examine the suitability of using different levels of sweet potato tubers as a source of energy on performance and carcass characteristics of broiler chicken. A total of 150 one – day old, unsexed broiler chicks (Ross 308 breed) with initial weight of approximately 38g were distributed in a completely randomized design with five dietary treatments. The diets formulated contained five levels of sweet potato and sorghum as the main source of energy at rates 0%, 15%, 25% and 40 % of the total rations + Standard ration (Kafi feed). Each group was subdivided into 3 replicates with ten birds each. Data were analyzed by using SPSS 22.0 program package. The performance (feed intake, weight gain and feed conversion ratio) indicated a significant difference in starter, finisher and entire phase, except for weight gain in starter period and feed intake in finisher and entire periods. However, there were no significant differences observed in chemical composition of meat, carcass and carcass cuts except for drumstick. Serum chemistry and hematological parameters of broilers blood were not affected also, except for albumin. The result indicated that 15% level of sweet potato tubers addition was the

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best in broiler performance especially body weight gain and feed intake which reflect desirable performance economically.

Keywords: Sweet potato tubers, Kafi feed, Broiler performance, Carcass Characteristics.

INTRODUCTION

Sweet potato is one of the five most important food crops in developing countries (Phuc *et al*., 2001). Traditionally, sweet potato was grown exclusively for the production of the tubers and the foliage was considered as a waste and therefore underutilized (Ruiz *et al*., 1981; Moat and McL Drylen, 1993). However, at present sweet potato is grown by smallholder livestock farmers as a dual-purpose crop. The vines are fed to livestock, whereas the tubers are used for human food (Karachi, 1982). Sweet potato (*Ipomoea batatas L)*. is a common crop, and has high biomass yields of both tubers and vines. Traditionally, sweet potato is used as human food, although at present it is commonly used as feed for farm livestock. The tubers have high carbohydrate content while the leaves are rich in protein, and both tubers and vines can be used as animal feed (Woolfe, 1992). The main sources of starch of the world today are corn, cassava, potato, wheat and rice (Alves *et al*., 2002). Sweet potato is one of the important sources of calories for people in the developing countries and is the seventh most important food crop grown in more than hundred countries. It is an important staple food for large sectors of the world population in the tropics where both the roots and tender shoots are eaten as a vital source of nutrients (Woolfe, 1992). Processed sweet potato meal has a Metabolizable energy level of 3180 Kcal/Kg and Crude protein of 5.36% (Abia and Akujobi, 2008). Sweet potato had a high production potential and can adapt to different types of soil. It is also a possible energy source, which can replace maize in poultry feeding (Ahmed *et al*., 2017). The sweet potato tubers contain toxic glycoalkaloids, proteinase inhibitors and lectins which limit its use as a livestock feed. The level of toxicity can be destroyed by prolonged exposure of tubers to sunlight (Singh *et al*., 2015). Sweet potato tubers are locally available plant energy sources in Sudan which could be used as a source of energy in broiler diets. This study had been carried out to examine the suitability of using different levels of sweet potato tubers as a source of energy on performance and carcass characteristics of broiler chicken.

MATERIALS AND METHODS

Study location

The experiment was conducted in Kenana Poultry Farm (Produce Farm), Kenana Sugar Company, White Nile State. The experiment was carried out to investigate the effect of sweet potato tubers as a source of energy in broiler diets.

Experimental procedures

A total of 150 one – day old, unsexed broiler chicks (Ross 308) were purchased from commercial local company, weighed, vaccinated and divided into 5 groups (30 birds/pen). Each group contains 3 repetitions with 10 chicks each. Throughout the experimental period Fresh water and feed were offered *adlibitum*.

Experimental Housing

The house was divided into 15 Pens. The dimensions of each individual pen was (100 cm) length, (100 cm) width and (50 cm) height. Each pen contained ten chicks, one plastic feeder and one plastic drinker.

Experimental diets

In a completely randomized design, the experiment was containing five dietary treatments to study the effect of dietary inclusion of sweet potato tubers on broiler performance and carcass characteristics. The diets formulated contained five levels of sweet potato and sorghum as the main source of energy at rates 0%, 15%, 25% and 40 % of the total rations + Standard ration (Kafi feed). In all phases of growing (starter and finisher) the diets contain zero level (no sweet potato) served as control diets. All diets were formulated iso-nitrogenous iso-caloric to meet or exceed the requirements of broiler starter and finisher diets according to (NRC, 1994)**.**

The experimental diets preparations

Sweet potato was planted, harvested and collected at research and development farm. Whole fresh tubers were washed, cleaned and knife chopped into small manageable slices and then was spread on a plastic raincoat and dried under direct sunlight within **8** days. The proposed dietary preparations for raw sweet tubers were carried out before feed formulation as follows: Proximate analysis, HCN analysis, Minerals and Tannins. The composition of the experimental diets is shown in Table 1. The proximate composition and nutritional level in feed during starter and finisher are presented in Table 2. Proximate composition of the different diets was determined as per standard procedure of Association of Official Analytical Chemists (AOAC, 2005).

Chemical composition of sweet potato tubers

Proximate analysis of sweet potato tubers

Raw and sun dried sweet tubers samples were subjected to proximate analysis at Veterinary research laboratory (Soba) Khartoum. Dry matter (DM), crude protein (CP), fat, crude fiber (CF) and ash content were determined according to the standard method of association of official analytical chemists (AOAC, 2005).

Table 1. Feed composition of broiler starter and finisher diets (0-5 weeks) of sweet potato

Ingredients	**Treatments %**							
	T_1		**T_2**		**T_3**		**T_4**	
	Starter	Finisher	Starter	Finisher	Starter	Finisher	Starter	Finisher
Sorghum Fetarita	54.5	66.0	36.9	45.0	25.5	33.0	8.0	18.0
Sweet potato	-	-	15.0	15.0	25.0	25.0	40.0	40.0
Groundnut cake	34.0	22.0	38.0	26.0	38.0	28.0	40.0	30.0
Wheat bran	3.4	3.4	2.0	5.4	6.4	5.4	3.9	3.4
Concentrate	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vegetable Oil	1.5	2.0	1.5	2.0	1.5	2.0	1.5	2.0
DCP	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Anti- toxins	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Anti - Coccidial	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Premix*	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NacL	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Methionine	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Lysine	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Limestone	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

*Vitamin = *mineral premix provided the following per kilogram of diet:* Vit. A 30789 IU, Vit. D 36 IU, Vit. E 115 IU, Vit. K 77 mg, Thiamine 39 mg, Pyridoxine 39 mg, Riboflavin 115 mg, calcium panthothenate 173 mg, Nicotinic acid 346 mg, VitB12 0.31 mg, Folic acid 19 mg, Manganese 3 g, Zinc 2 g, Iron 1 g, Copper 115 g, Iodine 38 mg, Cobalt 8 mg, Selenium 4 mg, Antioxidant 4 g, Chloride 8 g. DCP= Di calcium phosphate. *T1=0% Sweet, T2=15% Sweet, T3=25% Sweet, T4= 40% Sweet, T5 = Kafi feed.*

Table 2. Proximate composition of broiler starter and finisher diets of sweet potato tuber

Calculated analysis	Treatments %									
	T_1		T_2		T_3		T_4		T_5	
	Starter	Finisher	Starter	Starter	Finisher	Finisher	Starter	Finisher	Starter	Finisher
ME* Kacl/Kg	3155.5	3265.18	3163.6	3283.2	3184.2	3257.77	3184.2	3283.1	2950	3050
CP %	22.60	18.74	22.90	18.93	22.16	19.25	22.16	18.93	21.0	18.0
CF %	5.17	4.36	4.95	4.03	4.77	4.45	4.77	4.03	5.0	5.0
EE %	4.56	3.92	4.46	3.48	4.02	3.69	4.02	3.48	8.0	8.0
Ash %	4.66	3.83	4.96	4.57	5.28	4.43	5.28	4.57	9.0	9.0
NFE %	51.65	57.16	51.79	58.31	53.68	57.09	53.68	58.31	-	-
Lysine	1.33	1.86	1.63	1.95	2.07	1.68	2.07	1.95	1.30	1.00
Methionine	0.57	0.53	0.61	0.63	0.67	0.60	0.67	0.63	0.5	0.38

ME = Metabolizable energy Kcal /Kg, CP = Crude protein, CF = Crude fiber, EE = Ether extract, ASH = Ash, NFE = Nitrogen free extract, ME values of the feeds for poultry were estimated according to (MAFF, 1975) Equation.T1=0% Sweet, T2=15% Sweet, T3=25% Sweet, T4= 40% Sweet, T5 = Kafi feed.

Determination of minerals

Minerals were determined according to method analysis of (AOAC, 1976).

Anti-nutrient Analysis of sweet potato tubers

Determination of cyanide by titration

HCN of sweet potato tubers was determined according to method analysis of (AOAC, 1990).

Determination of Tannin

Tannin content of sweet potato tubers was determined according to method analysis of (Price *et al*., 1978).

Data Collection

Initial body weight of chicks was recorded at the commencement of experiment. Feed consumption and weight gain were weekly measured. Accordingly feed conversion ratio value were calculated. Mortality was recorded throughout the experimental period. At the end of week five, two birds from each pen were selected based on their weights to the average weight of the particular pen, slaughtered. The relative weights of internal organs, carcass and cuts and the length of intestine were recorded.

Meat characteristics

One sample of broiler breast muscle from each experimental unit (three birds per treatment), was stored in freezer (-20 ºC) pending evaluation of chemical analysis to determine crude protein, crude fat, ash, moisture and nitrogen free extract, according to the method of (AOAC, 1990).

Blood parameters

At the end of the experimental period blood samples were collected withdrawal period of two hrs. to decrease the effect of feeding on blood parameters of the broilers. One bird selected randomly from each experimental unit (three birds per treatment). Blood samples were collected from the wing –vein using 0-5ml insulin syringe and drawn into test tube containing anticoagulant, in order to determined cholesterol, tri-glyceride, total protein, albumin, glucose, cholesterol, and phosphorus. The packed cell volume (PCV or hematocrit) was determined using the standard micro hematocrit method. Total red blood cells, total white blood cells.

Statistical Analysis

Experimental data were presented as mean values ± standard errors of the mean ±St. statistical analysis were carried out by using the SPSS 22.0 program package (SPSS,

2013). The significance of the differences among the groups was determined by Duncan's multiple range Tests (Petrie and Watson 1999).

RESULTS AND DISCUSSION

Effect of dietary inclusion of sweet potato on broiler performance during starter period (1-3 weeks)

Table 3 shows the effect of inclusion different dietary levels of sweet potato tubers by T1 (0% Sweet potato), T2 (15% Sweet potato), T3 (25% Sweet potato) and T4 (40% Sweet potato) of the total ration + T5 Standard feed (Kafi feed) on broiler performance. The results showed significant differences (P≤0.05) in feed intake and feed conversion ratio. lower weight gains, Also the diets however became increasingly dusty with the increase levels of the sweet ingredient and this may have negative affect on growth performance. The results of parameters measured explained that there were no significant affected in weight gains by the addition of sweet potato tubers in diets fed to broiler chickens in this period. This not corroborated with the findings of Maphosa *et al.* (2003) who stated that a decline in weight gain was noticed with increase in the inclusion of sweet potato during the starter and finisher phases respectively. It may be due to different levels of sweet potato used.

Table 3. Performance of broiler chicks fed different levels of sweet potato meal at starter phase (1-3 weeks)

Parameters / Treatments	Feed intake (g)/bird	Weight gain (g)/bird	Feed conversion ratio(g:g)
T_1	238.07^{b}	197.08	1.19^{b}
T_2	246.33^{ab}	211.11	1.15^{b}
T_3	236.56^{b}	180.78	1.31^{ab}
T_4	278.42^{a}	186.10	1.45^{a}
T_5	280.91^{a}	235.78	1.17^{b}
±SE	13.35	15.87	0.072
Sig	*	ns	*

**= significantly at P≤0.05 ns= not significant* ±SE = *Standard error of mean* $^{a-b}$ *means values within Colum with no common superscripts are significantly different (P≤0.05),* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

Effect of dietary inclusion of sweet potato on broiler performance during finisher period (4-5 weeks)

Table 4 shows the broiler performance fed varying dietary levels of sweet potato tubers (T1, T2, T3 and T4) as a source of energy + T5 (Kafi feed) during finisher period. The results showed highly significant differences (P≤0.01) in feed conversion ratio and weight gain in all treatments. This agree with Jiwuba *et al.* (2016) who showed that sweet potato root meal can best replacement maize in diets of finisher broiler at 10% dietary level. Inclusion at 10% produced the best performance in all the

parameters evaluated without deleterious effect on performance, carcass and internal organs characteristics. This result differs with that reported by Maphosa *et al.* (2003) who revealed that feed conversion declined with increase in inclusion of sweet potato meal though not significantly up to 50% inclusion level. which may be attributed to high feed intake and low weight gains. The best weight gains in (T5, T1 and T2). The lowest weight gain showed in T4 and T3. There was no significant in feed intake. This corroborated with the findings of Maphosa *et* ***al.*** **(2003)** who stated that a decline in weight gain was noticed with increase in the inclusion of sweet potato during the starter and finisher phases respectively.

Table 4. Performance of broiler chicks fed different levels of sweet potato meal at finisher phase (4-5 weeks)

Parameters / Treatments	Feed intake (g)/bird	Weight gain (g)/bird	Feed conversion ratio(g:g)
T_1	715.76	431.76^{a}	1.44^{b}
T_2	696.00	408.16^{ab}	1.39^{b}
T_3	648.63	333.58^{bc}	1.61^{ab}
T_4	699.26	304.15^{c}	1.80^{a}
T_5	711.77	417.44^{ab}	1.39^{b}
±SE	34.89	29.74	0.081
Sig	**ns**	****	****

*ns= not significant *= significantly at P≤0.05 **=highly significantly at P≤0.01* ±SE = *Standard error of mean* $^{a-b-c}$ *means values within Colum with no common superscripts are significantly different (P≤0.05)* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

Effect of dietary inclusion of sweet potato on broiler performance during entire period (1-5 weeks))

The performance of the birds is shown in Table 5, there was no significant (P≥0.05) effects on dietary treatments in feed intake, however there were highly significant differences (P≤0.01) in weight gains and feed conversion ratio. During this study observed a decline in weight gain was noticed with increase in the inclusion of sweet potato during the starter and finisher phases respectively. The best weight gain showed in T5, T1 and T2. The lowest weight gains in T3 and T4. This results not agreement with Woolfe (1992) also reported the replacement of 50% to 75% maize in poultry fed with dried sweet potato flour without adverse effect on the growth of broiler chickens. Similar results reported by (Gerpacio *et al.*, 1978). The comparison was carried out on the basis of feed intake, weight gain, feed efficiency, dressing percentage and digestibility or availability of the major nutrients (dry matter, fiber, protein and energy). It was reported that the performance of birds fed sweet potato especially at the higher levels was less satisfactory compared to corn, suggesting that for the tuber, only 50% or at the most, 75% replacement of the corn is advisable. These may be due to high fiber content of sweet potato tubers un peeled used in the

current study. The results obtained in agreement with Tewe, (2001) evaluated the suitability of sun-dried sweet potato as poultry feed and found out that body weight gains and nutrient utilization reduced significantly with the inclusion of sweet potato at the levels of 50% and 100% maize replacement in broiler chicken diets.

Table 5. Performance of broiler chicks fed different levels of sweet potato meal during entire period (1-5 weeks)

Parameters / Treatments	Feed intake (g)/bird	Weight gain (g)/bird	Feed conversion ratio(g:g)
T_1	429.15	290.95^{a}	1.44^{b}
T_2	426.20	289.91^{a}	1.39^{b}
T_3	401.39	241.90^{b}	1.61^{ab}
T_4	446.76	233.32^{b}	1.80^{a}
T_5	453.25	308.44^{a}	1.39^{b}
±SE	15.49	15.79	0.081
Sig	**ns**	**	**

*ns= not significant *= significantly at P≤0.05 **=highly significantly at P≤0.01* ±SE = *Standard error of mean* $^{a-b}$ *means values within Colum with no common superscripts are significantly different (P≤0.05)* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

Effect of dietary inclusion of sweet potato on meat quality of broiler

The chemical composition of carcass meat fed different levels of sweet potato tubers presented in Table 6 the results revealed that the supplementation of feed with different levels of sweet potato tubers did not affect crude protein, moisture, dry matter. Similar findings have been reported by Maphosa *et al.,* (2003). No significant difference was observed in ether extract, ash and nitrogen free extract between the treatment groups utilized in this study. This agree with Lee and Yang (1979) reported that chickens fed diets containing a 24 percent substitution of corn with sweet potato grew as well as on the all-corn diet, with no significant difference in carcass quality.

Table 6. Chemical composition of meat fed different levels of sweet potato meal

Parameters / Treatments	Moisture%	DM %	CP %	EE %	Ash %	NFE %
T_1	70.33	29.67	17.63	3.47	1.47	48.40
T_2	68.67	31.00	17.87	3.57	1.47	46.03
T_3	72.17	27.83	17.90	3.53	1.47	49.70
T_4	70.33	29.67	17.80	3.47	1.50	48.83
T_5	72.17	27.83	17.27	3.47	1.50	49.73
±SE	1.21	1.14	0.196	0.116	0.08	1.48
Sig	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**

ns= not significant ±SE = *Standard error of mean DM=Dry matte CP=Crude protein EE= Ether extract NFE= Nitrogen free extract.* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

Effect of sweet potato tubers on carcass and carcass cuts

Table 7 show the effect of dietary inclusion of sweet potato on carcass and carcass cuts (T1, T2, T3 and T4) as a source of energy. There were no significant (P>0.05) differences in among treatment, there was significant (P≤0.05) in drumstick. The greatest weight showed in T2 compered the lowers weight showed in others treatments. This results obtained dis agreed with Jiwub *et al.,* (2016). Who evaluated carcass and organ characteristics of broiler finisher fed diets containing sweet potato roots, there were signifanct (P≤0.05) differences in dressed weight and dressing percentage. Also thigh muscle and breast muscle were significantly affected while drumstick back. This which may be due to levels used of sweet potato tubers.

Table 7. Effect of dietary inclusion of sweet potato on carcass and carcass cuts

Parameters	Treatments						
	T_1	T_2	T_3	T_4	T_5	±SE	Sig
Carcass weight %	70.66	70.75	72.31	68.22	71.38	1.93	**ns**
Breast%	17.22	16.97	18.87	15.89	16.29	1.33	**ns**
Thigh%	6.16	7.08	5.48	5.17	5.15	0.603	**ns**
Drumstick%	4.66^{b}	5.60^{a}	4.47^{b}	4.24^{b}	4.42^{b}	0.243	*
Abdomen fat%	0.88	0.52	0.79	0.77	0.49	0.156	**ns**

n.s = not significant *= *significantly at P≤0.05* ±SE = *Standard error of mean* $^{a-b}$ *means values within rows with no common superscripts are significantly different (P≤0.05)* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

Effect of dietary inclusion of sweet potato on internal organs of carcass

Table 8 show the effect of dietary inclusion of sweet potato on internal organs of carcass (T1, T2, T3, T4 and T5) as a source of energy. There were no significant (P>0.05) differences in liver and pancreas. However, there were significant (P≤0.05) differences observed in small intestine weight, heart, spleen and small intestine length.

Table 8. Internal organs of broiler chickens fed different levels of sweet potato

Parameters	Treatments						
	T_1	T_2	T_3	T_4	T_5	±SE	Sig
Liver%	2.22	2.37	2.17	2.14	1.88	0.172	**ns**
Heart %	0.49^{b}	0.70^{a}	0.67^{ab}	0.66^{ab}	0.47^{b}	0.059	*
Pancreas %	0.25	0.29	0.40	0.41	0.29	0.048	**ns**
Spleen %	0.28^{c}	0.49^{ab}	0.31^{bc}	0.56^{a}	0.31^{bc}	0.055	*
Small intestine weight %	2.49^{b}	3.02^{ab}	2.94^{ab}	3.62^{a}	2.60^{b}	0.216	*
Small intestine length (cm)	150.67^{ab}	131.17^{c}	129.50^{c}	155.50^{a}	135.83^{bc}	5.68	*

ns= not significant *= *significantly at P≤0.05* ±SE = *Standard error of mean* $^{a-b-c}$ *means values within rows with no common superscripts are significantly different (P≤0.05)* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

This agree with Maphosa *et al*., (2003) also showed that sweet potato inclusion produced a relatively higher (P≤0.05) weight of pancreas, intestine and caeca for birds on and above 50% maize replacement levels, which was not different from those on control diet. The increased in small intestine length and weight were attributed to increased retention time of digesta on fibrous diets. The increased in spleen and heart weight could be due to Hydrogen Cyanide of sweet potato tubers (HCN).

Effect of sweet potato tubers on serum blood chemistry

Table 9 shows the effect of inclusion of different dietary levels of sweet potato tubers (T1, T2, T3 and T4+ T5) by 0%, 15%, 25% and 40% of the total ration respectively + Standard feed (Kafi feed) on blood chemistry. The results revealed that all parameters value of blood chemistry (Phosphorus, Glucose, Triglyceride, Cholesterol and Total protein) were not affected significantly (P>0.05) by the usage sweet potato tubers in diets fed to broiler chickens throughout the experimental period, except for Albumin. There were no significant in of all treatments. Moreover, the present study revealed that dietary addition of sweet potato tubers reduced the Albumin remarkably (P≤0.05).

Effect of sweet potato on hematological parameters of blood

Table 10 shows the effect of inclusion of different dietary levels of cassava roots (T1, T2, T3 and T4 + T5) by 0%, 15%, 25% and 40% of the total ration respectively + Standard feed (Kafi feed) on blood hematological. The results stated that there was no significant affect in parameters measured of all treatments.

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Table 9. Effect of sweet potato meal on serum chemistry of broilers

Parameters / Treatments	Phosphorus mg/dl	Albumin gm/dl	Glucose gm/dl	Triglyceride gm/dl	Cholesterol gm/dl	Total Protein gm/dl
T_1	5.37	1.73^{ab}	202.67	43.33	122.33	2.27
T_2	5.10	1.90^{a}	168.00	24.00	102.33	2.90
T_3	5.33	1.73^{ab}	206.33	36.67	118.00	2.20
T_4	5.43	1.63^{b}	160.33	28.67	123.00	2.30
T_5	5.17	1.87^{a}	181.10	23.67	117.00	2.60
±SE	0.160	0.054	16.96	5.27	6.67	0.376
Sig	**ns**	*****	**ns**	**ns**	**ns**	**ns**

**= significantly at P≤0.05 ns= not significantly* ±SE = *Standard error of mean* $^{a-b}$ *means values within Colum with no common superscripts are significantly different (P≤0.05)* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

Table 10. Effect of sweet potato meal on hematological parameters of broilers blood

Parameters / Treatments	Pcv %	Hb (g/dL)	RBCs ($\times 10^6$/ML)	WBCs ($\times 10^3$/ML)	Platelet ($\times 10^3$/ML)
T_1	30.90	10.20	2.44	281.20	15.67
T_2	27.93	9.30	2.18	279.50	14.33
T_3	28.00	9.27	2.21	268.20	11.00
T_4	28.50	9.23	2.23	278.80	18.33
T_5	31.07	10.30	2.45	288.33	15.33
±SE	1.263	0.413	0.098	5.42	2.34
Sig	**ns**	**ns**	**ns**	**ns**	**ns**

ns= not significant PCV = Packed cell volume %; RBC = Red blood cell x10^6/ml; WBC= White blood cell x10^3/ml; Hb = Hemoglobin, n.s = not significantly ±SE *= Standard error of mean* $^{a\text{-}b\text{-}c}$ *means values within Colum with no common superscripts are significantly different (P≤0.05)* T1=0% Sweet potato, T2=15% Sweet potato, T3=25%Sweet potato, T4=40%Sweet potato, T5=Kafi feed.

CONCLUSION

Sun drying processing reduced the anti-nutritional factors of sweet potato tubers which made the nutritional components of sweet potato be more bioavailable, these results suggested that, as an energy source, sweet potato tuber is as efficiently utilized by chicks. Based on the current study sweet potato tubers could be included in broiler diets up to 15% without adverse effects in broiler performance.

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REFERENCES

Abia, S. A., and R. Akujobi. 2008. Replacement value of processed sweet potato meal for maize grain on the performance of broiler finisher. *Imo State Polytechnic, Umuagwo, Nigeria*. pp. 81.

Ahmed, H.A., M. A. Abdel-Latif, A.A. Ghoraba, and S.A. Ganna. 2017. Comparative effect of microbial phytase supplementation on layer chickens fed diets with required or low phosphorous level. *Journal of Poultry Science and Technology*, 5(4): 35-43.

Alves, R.M., M.V. Grossmann, C. Ferrero, N.E. Zaritzky, M.N. Martino, and M.R. Sierakoski. 2002. Chemical and functional characterization of products obtained from yam tubers. Starch/ Stärke 54: 476 – 481.

AOAC. 1976. *Official Methods of Analysis*, Spectrophotometry determination of elements, *journal of AOAC International* volume 59, issue 5.

AOAC. 1990. *Official Methods of Analysis*, 17th Ed Association of Official Analytical Chemists, Arlington, VA, USA. Washington, D.C.

AOAC. 2005. *Official Methods of Analysis*. Association of official analytical chemists., 16th Edition 481 north Ferdrick avenue Gaithersburg, Maryland, USA

Gerpacio, A.L., F.S.D. Pascual, L.J. Querubin, A.F. Vergel de Dios, and C.I. Mercado. 1978. Evaluation of tuber meals as energy sources. In sweet potato and cassava based rations for broilers. *Philippine agriculturalist* 61(9-10) 395-410

Jiwub, P. C., E. Dauda, M. U. Onyekwere, and S. O. Okechukwa. 2016. Responses of Broiler Finisher Birds Fed Diets Containing Sweet Potato (*Ipomoea batatas*) Root Meal. Federal Collage of Agriculture. Ebonyi State, Nigeria. 1(4):1-7.

Karachi, M. K. 1982. The performance of sweet potato (*Ipomoea batatas Lam*) in Western Kenya. Part 1. Effect of nitrogen and phosphorus combination on yield of 31 cultivars. *East Africa Agriculture Forest Journal*. 47 (3), 55–59.

Lee, P.K., and Y.F. Yang. 1979. Comparative study of high protein sweet potato clips and common sweet potato clips as substitute for corn grain in diet on growth, feed efficiency and carcass quality on the growing fattening pigs. *Journal of the Taiwan livestock Research* 12 (1) 31-48.

MAFF. 1975. *Ministry of Agriculture, Fisheries and Food*. Energy allowances and feeding system for poultry. Maff Technical Bulletin, No.33. London, HMSO – 194. DOI:10.1111/j-154-4337-2009. 00077.x(2016), Article ID 2963681.3 Pages.

Maphosa, T., K.T. Gunduza, J. Jusina, and A. Mutungamiri. 2003. Evaluation of sweet potato tuber (*Ipomoea batatas L.*) as a feed ingredient in broiler chicken diets. Livestock Research for Rural Development 15 (1) 252-262

Moat, M., and G. McL-Drylen.1993. Nutritive value of sweet potato forage (*Ipomoea batatas Lam*) as a ruminant animal feed. Papua New Guinea *Journal of Agriculture, Forestry and Fisheries*. 36 (1), 79–85.

NRC. 1994. *National Research Council* Nutrient Requirements of Poultry. 9th Rev. Edn., National Academy Press, Washington DC., USA.

Petrie, A., and P. Watson. 1999. Statistics for veterinary and Animal Science. 1st Ed., The blachwell Science Ltd, UK.

Phuc, BHN., J.E. Lindberg, B. Ogle, and S. Thomke. 2001. Determination of the nutritive value of tropical biomass products for monogastrics using rats. Part 2. Effects of drying temperature. *Asian Australasian Journal of Animal Science*, 14 (7), 994– 1002. 2nd Edition. Spelderholt Centre for Poultry Research and Extension, Beekbergen. Jensen, L.S., L.N.

Price, M.L., S. Van Scoyoc, and L.G. Butler. 1978. A critical evaluation of the vanillin reaction as an assay for tannin in sorghum. *Journal of Agricultural and Food Chemistry*, 26, 1214–1218.

Ruiz, M.E., E. Lozano, and A. Ruiz. 1981. Utilization of sweet potatoes (*Ipomoea batatas Lam*) in animal feeding. Part III. Addition of various levels of roots and urea to sweet potato forage silages. Tropical Animal Production, 6, 234–244.

Singh, J., A.P.S. Sethi, P. Singh, J. Kaur, J.S. Hundal, and U. Singh. 2015. Response garlic supplementation on commercial broiler performance: *A review. International Journal of Animal and Veterinary Scienc*es, 2: 51-55.

SPSS. 2013. 22.0. SPSS for Windows. SPSS, Chicago, IL.

Tewe, O.O. 2001. Sweet potato utilization in poultry diets. In Tropical Root Crops, Developing Economy food and Agricultural Organization (FAO) production year book.

Woolfe, J.A. 1992. Sweet potato, an untapped feed resource. University Press. Cambridge, UK 643.