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EFFECTS OF SWEET POTATO (Ipomea batatas) MEAL AS SOURCE OF ENERGY IN THE DIETS OF BROILERS AT FINISHER STAGES ON CARCASS CHARACTERISTICS IN ZAMFARA STATE, NIGERIA.

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ABSTRACT

An experiment was conducted to determine the effect of feeding sweet potato meal to broilers. A total of two hundred and fifty (250) day old broilers of Abore acre strain were used for the trial. The birds were randomly divided in to 25 groups of 10 chicks each. Five groups were randomly allocated to five dietary treatments as replicates. The treatments consisted of diet 1 (100% maize/ 0% sweet potato),

INTRODCTION

Poultry refers to all domesticated birds kept for meat, eggs or for any other reasons (Abubakar and Abdullahi, 2009). Poultry embraces all types of fowls including Chickens, Guinea fowls, Turkeys, Ducks, Geese and Pigeons. Poultry are domesticated birds kept by humans for the eggs they produce, their meat, their feathers or some time as pets. Poultry production is regarded as a means of sustainable livelihood and a way of achieving a certain level of economic independence [1].

Poultry keeping is regarded as a lucrative business with investment opportunities in production of table eggs and meat [2]. However, in countries like Nigeria, local fowls with low production potentials are maintained under rudimentary forms of extensive system, which is characterized by low output. In Nigeria, the production of food has not increased at the rate that can meet the demand of the increasing population; food production increases at the rate of 2.5% while food demand increases at a rate of more than 3.5% due to the high rate of population growth of 2.83% [3]. Poultry production in the past was not counted among important occupation; in some communities, the fowl is used in the past as a means of knowing the time. Nowadays, poultry production has developed and occupies a place of pride among livestock enterprises due to its rapid monetary turnover [4].

diet 2 (75% maize/ 25% sweet potato), diet 3 (50% maize/ 50% sweet potato), diet 4 (25% maize/ 75% sweet potato) and diet 5 (0% maize/ 100% sweet potato). The proximate analysis of the feed samples and sweet potato meal were carried out. Data collected at finisher stage; on final body weight, dresses weight dressing percentage, thigh and shank weight, breast weight, neck weight, head weight, wing weight, gizzard weight, liver weight, heart weight, intestine weight and abdominal fat weight were recorded. The data were subjected to Analysis of Variance (ANOVA) using SAS statistical package. The results recorded at finisher stage indicated that, there was significant difference (P<0.05) on body weight gain. The results of the carcass analysis indicated that, there was significant difference (P<0.05) for all the parameter with the exception of head and gizzard. The results of the cost of production of the test ingredients showed no significant difference (P<0.05) on total feed intake/kg/b and cost of feed consumed/b/₦ while a significant difference (P>0.05) were observed on body weight gain/kg/b, cost of feed/kg/ (₦) and cost of live weight gain/b/ (₦) by broilers at both starter and finisher phases. It could be concluded from the results of the study that, control diet and 50% level of inclusion are better.

Keywords: *Meal, Source, Energy, Broilers, Finisher, Carcass Zamfara State.*

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The principal problem facing the poultry industry today particularly broiler production, remains the high cost of poultry feeds resulting from soaring costs of grains. The high costs of grains is due to the competition for the grains between livestock feed mills and other large scale demands such as human consumption and industrial uses as in the case of breweries and confectionaries. The conventional energy feed sources constitute between 40-65% of formulated poultry diets and have high tags as a result of their numerous alternative uses [5]. Among these sources, maize is the most widely used for poultry feed formulation [6]; [7]. In order to stem the tide of high and unstable price situation and save the collapse of the poultry industry, there is need to broaden the energy source base by assessing unconventional feed stuff [6]. It is for this purpose that sweet potato meal is being evaluated as an alternative source of energy in broiler diets in this study. The prices of poultry products especially eggs keep on rising as a result of the rise in the cost of feed which constitute between 60-70% of the total cost of production ([8]. All over the globe, poultry meat and eggs are preferred to other kinds of animal food products for a variety of reasons.

Poultry products such as meat and eggs are considered as excellent sources of proteins necessary to meet the protein requirements of both infants and vulnerable people [9]. [10] has shown the quantity of feed required by broiler/layer for their products and reported that a layer bird will require 3.9 kg of feed to produce 1 kg of egg while a broiler may require only 1.9 kg of feed to give 1 kg of meat.

Sweet potato (*Ipomea batatas* L.) belong to the family of *Convulvulacae* and originated from Latin America. Sweet potato is grown in most parts of the tropics and warmer temperate regions [11]. Sweet potato ranks the fifth most important food crop on a fresh weight basis in developing countries after rice, wheat, maize and cassava. The crop is cultivated in 114 countries and ranks among the five most important food crops in over 50 countries. China accounts for 85% of global sweet potato production [12]. Sweet potato is a minor crop in Nigeria; it is cultivated in a few areas by subsistence farmers. The crop is mainly grown in Benue, Taraba, Plateau, Yobe, Kaduna, Kano, Kwara, Bauchi, Kebbi, Sokoto, Borno, Adamawa, Jigawa, Oyo and Ogun States [13]. Although, Zamfara State has not been mentioned in the list, sweet potato is widely grown

in large quantity across the State which indeed motivated its use as energy source in the diets of broilers.

Sweet potato is an excellent source of vitamin A (in the form of beta carotene), a very good source of vitamin C, manganese and good source of copper, dietary fibre, potassium and iron [14]. Thus, in Ethiopia, about 81.5% of the total production of sweet potato is used for home consumption, 9.6% for sale, 6.1% for animal feeding, 0.6% for planting, 0.42% for wages in kind and 1.83% for other uses [15]. [16] reported that, sweet potato is rich in antioxidants; it has anti-aging nutrients which are phytochemicals or substances (mostly present in fruits and vegetables), which neutralizes the free radicals generated by the body during metabolism; when not neutralized, the free radicals travel through the body cell disrupting the structures of protein, lipids, carbohydrates, causing cell damages believed to contribute to aging and development of degenerative diseases such as cancer and heart diseases among others.

The sweet potato (fresh basis) contains approximately 20% starch and 5% simple sugars, the protein of sweet potato contains about two third globulin with reasonable amount of most amino acids but is limiting in tryptophan, lysine and the sulphur containing in amino acids [17]. In sweet potato, the toxic factors limiting its use as poultry feed are trypsin inhibitor [18, phytate-phosphorous content, oxalate [19], saponin, tannins and glycoalkaloids [20]. The glycoalkaloids are much concentrated in potato tuber particularly the peels [20]. Other factors include powdery and dusty nature, high moisture content [21]. Sweet potato is available and very cheap in the study area. The study would provide information that will reduce the competition for the scarce grains between human beings and animals; in addition to that, the study would provide information to feed millers. The study would also provide base line data for further research in the study area.

Objectives of the Study

The major objective of the study is to determine the impact of sweet potato meal as a source of energy in the diets of broilers at finisher stages of growth.

Specifically, the study attempts to:

i. Evaluate the carcass characteristics of broiler chickens fed sweet potato meal at the end of the finisher stage
ii. Determine the cost of production of the test ingredients fed to both broilers at starter and finisher stages of growth.

MATERIALS AND METHODS

Study Area

The study was conducted at the Poultry Production Unit of the Directorate of Animal Health and Livestock Development located at old Kara Gusau, Zamfara State. Zamfara State was created out of Sokoto State in 1996. It covers a geographical land area of 38, 418 square kilometers with an estimated population of 3,259,846 people [22]. It is located between Latitude 12° 09¹ 15" N and Longitude 06° 40¹ 0" E [23]. The State shares boundary with Sokoto state and the republic of Niger to the north, Kebbi and Niger States to the west, Katsina State to the east, and Kaduna State to the South. The climate of Zamfara state is characterized by a long hot-dry season lasting from October to May and a short warm wet (rainy) season that usually starts in mid-May and ends in September. The average annual rainfall of the area is between 550-900mm, with duration of 3-5 months [24]. The maximum temperature of the area is 41°c has been reported in April and minimum of 13.2°c in January while the relative humidity varies from 20 to 72% in the morning and from 7.5 to 63% in the afternoon [24].

Sources of Experimental Materials

Fresh white sweet potatoes were purchased in bulk from local markets. The potato (both tubers and peels) were washed free of dirt, manually sliced into chips of smaller thickness to facilitate drying and sun-drying by spreading them on cement floors. The dried sweet potato were ground into meal and used for feed formulation. Other ingredients use in formulating the diets are: groundnut cake, maize, soya beans cake, wheat offal, lysine, methionine, limestone, bone meal, salt etc.

Experimental Design and Diets

Five experimental diets were formulated; diet 1, with zero level of sweet potato meal and served as control. The four remaining diets were

formulated to contained sweet potato meals at 25, 50, 75 and 100% replacement levels of maize designated as diets 2, 3, 4 and 5 respectively. The diets were used to fed the broiler birds during the feeding trials at starters and finishers phases.

A total of two hundred and fifty (250) day old broiler chicks of *Abore acre* strain of mixed sexes were purchased from commercial farm called Yamfy farm at Kwara State Nigeria through their authorized Poultry Vendor in Gusau and used for the experiment. The experimental birds were kept for three days after transport to take care of stress due to transportation. During the period, anti-stress and anti-biotic were administered to the birds. After the three days, the birds were weighted and allocated them to their replicate groups which served as their initial weight for starter. The chicks were randomly allotted to five experimental treatments each, replicated five times making a total of 25 replicates at the starter phase. At the finisher phase, the birds were pooled and re-randomized to five treatment groups each, replicated five times and fed the finisher diets. The experimental design used for the trial was completely randomized design (CRD). The starter experiment was terminated at 0-4 weeks and 5-8 weeks for the finisher. The gross and calculated chemical composition of the experimental diets were shown in Table 1, and Table 2.

Experimental Birds and General Flock Management

The birds were raised on deep litter system; feed and water were given *ad-libitum*. The house was washed, cleaned and disinfected before the arrival of the birds. Routine vaccination and medication were followed as recommended by [25].

Data Collection

The data collected during the trial include: final body weight, dressed weight dressing percentage, thigh and shank weight, breast weight, neck weight, head weight, wing weight, gizzard weight, liver weight, heart weight, intestine weight and abdominal fat weight were recorded and mortality. Mortality was recorded as it occurred.

Laboratory Analysis of Sweet potato

Proximate analysis for dry matter, nitrogen, ash, crude fat and crude fibre contents of sweet potato meal and feed samples were conducted using the [26] methods.

Table 1: Gross Composition of Experimental Diets (Broiler Starter)

Ingredients	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPM T5
Maize	50.00	37.50	25.00	12.50	0.00
Sweet Potato Meal	0.00	12.50	25.00	37.50	50.00
Soya bean meal	22.00	22.00	22.00	22.00	23.10
Groundnut Cake	15.50	16.30	16.50	17.30	17.00
Wheat Offal	7.90	7.00	7.00	5.80	5.00
Blood Meal	0.45	0.45	0.45	0.45	0.45
Lime Stone	1.00	1.00	1.00	1.30	1.30
Bone Meal	2.00	2.00	2.00	2.00	2.00
Vitamin/Mineral Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100
Calculated Chemical Composition					
M.E. (Kcal/kg)	3015	3023	3034	3039	3043
Crude Protein (%)	23.00	23.00	23.00	23.00	23.00
Lysine (%)	1.30	1.30	1.30	1.30	1.40
Methionine (%)	0.60	0.60	0.60	0.60	0.60
Calcium (%)	1.00	1.30	1.50	1.80	2.00
Available Phosphorous (%)	0.60	0.60	0.60	0.60	0.60
Crude Fibre (%)	5.60	5.70	5.90	6.00	6.10
Ether Extract (%)	4.90	4.70	4.40	4.30	4.00

***Vitamin/Mineral Premix contained; Vitamin A, 1000 I.U, Vitamin D1,3000 I.U., Vitamin E 8.0 I.U., Vitamin K, 2.0mg; Vitamin B1, 2.0mg; Vitamin B6, 1.2mg; Vitamin B12, 0.12mg, Pantothenic acid, 7.0mg, Mg 1000mg; Cu, 8.0mg, Co, 0.45mg and Se, 0.1mg per kg of diet.

SPM= Sweet Potato Meal

Table 2: Gross Composition of Experimental Diets (Broiler Finisher)

Ingredients	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPM T5
Maize	50.00	37.50	25.00	12.50	0.00
Sweet Potato Meal	0.00	12.50	25.00	37.50	50.00
Soya bean meal	21.90	21.20	22.00	22.00	22.00
Groundnut Cake	11.00	12.00	12.00	12.40	12.50
Wheat Offal	11.00	11.00	10.00	9.50	9.00
Lime Stone	1.50	1.50	1.50	1.50	1.50
Bone Meal	3.40	3.10	3.30	3.40	3.30
Vitamin/Mineral Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100
Calculated Chemical Composition					
M.E. (Kcal/kg)	2900	2916	2919	2924	2931
Crude Protein (%)	21.00	21.00	21.00	21.00	21.00
Lysine (%)	1.30	1.30	1.30	1.30	1.30
Methionine (%)	0.60	0.60	0.60	0.60	0.60
Calcium (%)	1.50	1.70	2.00	2.20	2.40
Available Phosphorous (%)	0.70	0.70	0.70	0.70	0.70
Crude Fibre (%)	5.10	5.30	5.40	5.50	5.70
Ether Extract (%)	4.40	4.30	4.00	3.80	3.60

***Vitamin/Mineral Premix contained; Vitamin A, 1000 I.U, Vitamin D1,3000 I.U., Vitamin E 8.0 I.U., Vitamin K, 2.0mg; Vitamin B1, 2.0mg; Vitamin B6, 1.2mg; Vitamin B12, 0.12mg, Panthotenic acid, 7.0mg, Mg 1000mg; Cu, 8.0mg, Co, 0.45mg and Se, 0.1mg per kg of diet.
SPM= Sweet Potato Meal

Carcass Evaluation

After the eighth week, three birds per replicate were slaughtered, by cutting the jugular vein and allowed to bleed. Warm water was used to remove feather of the slaughtered bird after which they were weighed for determination of dressed weight and dressing percentage. After

dressing, the carcasses were eviscerated and cut in to primal parts for carcass evaluation. Organs such as intestines, abdominal fat, liver, kidney, lungs, and gizzard were also weighed for evaluation.

Data Analysis

The data collected was subjected to Analysis of Variance to test for significance while treatment means were compared using Least Significant Difference (LSD) using Stat View [27].

RESULTS AND DISCSSION

The Proximate Composition of Sweet Potato and the Experimental Diets.

The proximate composition of the sweet potato, starter and finisher experimental diets were presented in Table 3, 4, and 4.5 respectively. Dry matter (DM) value for sweet potato was 91.18%. The dry matter value obtained in this study was in conformity with the report of [20]. However the value was higher than the value (89.60%) reported by [28]. Crude protein (CP) value for sweet potato was 3.55%. The value obtained in this study was lower than the value 6.40 reported by [29]. The total Ash value (3.75%) was close to the values of 3.1 and 3.2% reported by [30] respectively. Crude fibre (CF) level was 1.49 which is higher compared to values 0.30 and 0.36% reported by [31]. Metabolizable energy value was (3089.8) kcal/kg. The value obtained in this study was higher than the value 2899.70 reported by [32].

Much of these differences from the chemical composition of the potato obtained during the analytical procedures and the values reported in literature could be due to differences in varieties, soil fertility, cultural practices during cultivation and the analytical procedure themselves.

Table 3: Proximate composition of sweet potato

Parameter (%)	Composition
Dry Matter	91.18
Crude Protein	3.55
Crude Fibre	1.49
Fat	1.60

Ash	3.75
Energy (M.E. Kcal/kg)	3089.8

Table 4.: Proximate composition of the experimental starter diets

Nutrients	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPM T5
Dry Matter (%)	91.70	91.40	91.70	91.70	92.10
Crude Protein (%)	23.60	23.10	22.70	22.90	22.50
Crude Fibre (%)	4.10	3.70	3.50	2.90	2.50
Fat (%)	6.50	5.20	4.50	3.60	2.90
Ash (%)	10.56	10.30	10.65	10.95	11.85
Energy(M.E. Kcal/kg)	3047.80	2998.6	2970.25	2939.03	2901.97

SPM= Sweet Potato Meal

Table 5: Proximate composition of the experimental finisher diets

Nutrients	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPM T5
Dry Matter (%)	91.30	91.10	91.40	91.10	91.30
Crude Protein (%)	21.30	21.20	21.10	20.00	20.30
Crude Fibre (%)	3.60	3.80	3.80	3.60	3.90
Fat (%)	4.90	4.80	4.40	4.50	3.90
Ash (%)	9.99	10.78	10.59	10.70	9.85
Energy(M.E Kcal/kg)	2991.77	2945.24	2943.47	2938.60	2937.37

SPT= Sweet Potato

Carcass Characteristics of broilers fed graded levels of potato meal at finisher

The carcass characteristics of broilers fed graded levels of sweet potato meal in place of maize at finisher phase (5-8 weeks old) are shown in Table 6.

Table 6: Carcass Characteristics of Broiler Finisher (5-8 weeks of age)

	0%SPM	25%SPM	50%SPM	75%SPM	100%SPM	
Parameters	T1	T2	T3	T4	T5	SEM
Live Weight (g)	1590.00^{a}	1468.00^{b}	1504.00^{a,b}	1360.00^{c}	1354.00^{c}	28.78
Dress Weight (g)	1294.00^{a}	1238.00^{a}	1248.00^{a}	1140.00^{b}	1094.00^{b}	23.38
Dressing %	81.41^{a}	84.34^{a}	82.98^{a}	83.86^{a}	80.86^{a,b}	0.99
Thigh & Shank (g)	398.00^{a}	364.00^{b}	376.00^{a,b}	330.00^{c}	321.00^{c}	9.00
Breast Weight (g)	309.00^{a}	303.00^{a}	301.00^{a,b}	284.00^{b,c}	268.00^{c}	5.52
Neck Weight (g)	68.00^{a}	62.00^{b,c}	63.00^{a,b}	58.00^{b,c}	57.00^{b,c}	1.84
Head Weight (g)	53.00	57.00	54.00	54.00	52.00	1.90
Wing Weight (g)	130.00^{a}	134.00^{a}	130.00^{a,c}	125.00^{a,c}	122.00^{b,c}	1.79
Gizzard Weight (g)	53.00	51.00	52.00	52.00	51.00	1.28
Liver Weight (g)	29.60^{a}	33.60^{a,c}	29.00^{a}	27.00^{a}	23.00^{a,b}	2.32
Heart Weight (g)	15.00^{a}	13.60^{a,c}	13.40^{a,c}	12.60^{b,c}	12.20^{b,c}	0.52
Intestine Weight (g)	193.00^{a}	183.00^{a,c}	177.00^{b,c}	169.00^{b,c,d}	161.00^{c,d}	4.80
Abdominal Fat Weight (g)	24.60^{a}	24.40^{a}	24.40^{a}	23.00^{a,c}	20.40^{b,c}	0.87

SEM= Standard Error of Mean

a,b,c means carrying similar superscripts along the same row are not significantly difference (P>0.05)

The results of the carcass analysis were presented on the Table 6. From the results, the live weight of finisher broilers on the control treatment was significantly better (P<0.05) compared to the birds fed different levels of sweet potatoes. However, the dressed weight did not follow

the same pattern with live weight. The dressed weight of chicks for diets 1, 2 and 3 were not affected by the levels of sweet potatoes in diets. Chicks for diets 4 and 5 were similar (P>0.05) with each other. Dressing percentage for birds on all treatment diets did not differed (P>0.05) significantly. Breast muscles of chicks fed control, 25 and 50% sweet potatoes levels were similar (P>0.05). Gizzard weight of all chicks for all experimental diets were similar (P>0.05). However, heart weight of the chicks were significantly (P<0.05) affected. Abdominal fats for all birds were similar (P>0.05) except for chick fed 100% sweet potatoes which had significantly (P<0.05) lower abdominal fat when compared with their counterpart on diets 1 and 2.

Weights of prime cuts relative to dressed weight

The weights of primal cuts relative to dressed weight (%) are shown in Table 7.

Table 7: weights of prime cuts relative to dressed weight

Parameter (%)	0%SPM T1	25%SPM T2	50% SPM T3	75% SPM T4	100%SPM T5
Thigh & shank	30.76	29.40	30.12	28.94	29.34
Breast muscles	23.87	24.47	24.11	24.91	24.49
Neck	5.25	5.0	5.04	5.08	5.21
Head	4.09	4.6	4.32	4.73	4.75
Wing	10.04	10.82	10.41	10.96	11.15
Intestine	14.91	14.78	14.18	14.82	14.71
Abdominal fat	1.90	1.97	1.95	2.01	1.86

The results of this study indicated that, all the parameters were affected with the exception of head and gizzard. The results were in agreement with the reports of [33], [34] and [28] who reported that, the carcass characteristics were affected with the exception of gizzard. However, it contradicted the reports of [35] and [6] who reported that, the carcass characteristics were not affected with the inclusion levels of sweet potato with the exception of breast and intestine.

Table 8: Cost of Production of the test ingredients for Starter

Parameters	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPMT5	SEM
Total Feed Intake/kg/b	1.428	1.387	1.505	1.428	1.487	0.11
Body Weight Gain/kg/b	0.511^{a}	0.409^{b}	0.392^{b,c}	0.354^{b,c}	0.329^{c}	0.03
Cost of Feed/kg (₦)	133.87^{a}	132.68^{b}	126.19^{c}	119.83^{d}	114.28^{e}	0.30
Cost of Feed Consumed/b/(₦)	191.27	184.06	190.01	171.17	170.00	1.37
Cost of Live weight gain/b/(₦)	307.10^{a}	245.56^{b}	235.61^{b,c}	212.56^{b,c}	197.66^{c}	1.89

From the results of the study (Table 8), total feed intake/b/kg and cost of feed consumed/b (₦) were not affected significantly (P>0.05). However, body weight gain/b/kg, cost of feed/kg (₦) and cost live weight gain/b (₦) was significantly (P<0.05) affected by the inclusion levels of sweet potato.

Table 9: Cost of Production of the test ingredients for Finisher

Parameters	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPM T5	SEM
Total Feed Intake/kg/b	2.98	2.84	3.06	3.15	3.18	0.01
Body Weight Gain/kg/b	1.05^{a}	0.96^{a,b}	0.97^{a,b}	0.91^{a,b}	0.88^{c}	0.004
Cost of Feed/kg (₦)	137.37^{a}	134.99^{b}	128.21^{c}	121.02^{d}	113.32^{e}	0.36
Cost of Feed Consumed/b/(₦)	410.47	383.80	392.69	381.68	360.80	1.75
Cost of Live weight gain/b/(₦)	631.37^{a}	576.51^{a,b}	584.97^{a,b}	550.28^{a,b}	529.62^{c}	2.61

The non-significant effects on total feed intake and cost of feed consumed by broilers at both starter and finisher between the treatments indicated that, birds could utilize sweet potato meal without any adverse effects. The results were not in agreement with the reports of [36] and [33] who reported significant difference on feed intake. The results of the body weight gain, cost of feed/kg and the cost of live weight gain/b obtained from this study were in agreement with the report of [6] who reported that, cost of feed/kg and cost of live weight gain/b were not similar.

The non-significant effects on mortality of broilers at both starter and finisher between the treatments indicated that, birds could utilize sweet potato meal without any adverse effects. The results were in agreement with the reports of [37], [38] which showed that, the levels of sweet potato meal had no effect on mortality rate in their studies. However, it also contradicted the report of [33] which showed that, mortality increases with increase in sweet potato inclusion levels in the diets beyond 25% for starter.

Mortality

The mortality of chicks for all treatment diets were similar (P>0.05). Mortality obtained was higher than the normal mortality of 5% as recommended by [25], this was due to the outbreak of infectious bursal disease (Gomboro) at the 2nd day of 4th weeks for starter and coccidiosis at 7th weeks for finisher phase.

CONCLUSION

From the results of the experiment, control diet showed better performance than treatment diets at both starter and finisher phases. Therefore it could be concluded that, control diet and 50% level of inclusion are better for broiler starters and finishers respectively.

REFERENCES

Nworgu, F.C.(2007). Economic importance and growth rate of broiler chickens served with fluted pumpkin (*Telfaria occidentalis*) leaves extract. *African Journal of Biotecnology* **6**(2):167-174.

Ifenkwe, G.E. and G.O. Chukwu (2001). Risk aversion among poultry farmers. Proceedings of the 9th annual conference of Nigerian rural sociology association (NRSA). Usmanu Danfodiyo University Sokoto, Nigeria.

FOS, 1996. Federal Office of Statistics, population figures publication.

Laseinde, E.A.O. (1994). Terminology in poultry production. Tropical Agricultural Production series.

Afolayan, S.B. (2010). Evaluation of sweet potato meal as a source of energy in the diet of chickens. PhD Thesis, Department of Animal Science, Ahmadu Bello University Zaria, Nigeria.

Afolayan, S.B., I.I. Dafwang, T.S.B. Tegbe and A. Sekoni (2012). Response Of broiler chickens fed on maize based diets substituted with grade Levels of sweet potato meal. *Asian Journal of Poultry Science*, 6: 15-22.

Vantsawa, P.A. (2001). Replacement Value of Local Maize Offal (Dusa) for Maize in broiler diets. *Niger. J. Biotech*., 12:25-28.

Smith, A.J. (2001). *The Tropical Agriculturalist*. Macmillan publishers ltd., London. Pp. 30-35.

Olawumi, S.O., S.O. Fajemilehin and S.S. Fagbuaro (2012). Genotype and sex interaction effect on carcass traits of three commercial broiler chickens. *Journal of World Poultry Research,* 2(1):21-24.

Abubakar, M.M. (1998). Utilization of unconventional feedstuffs for sustainable livestock production. Inaugural lectures series No. 9. Abubakar Tafawa Balewa University Press, Bauchi.

Onwueme, I.C. and T.O. Singh (1991). Field Crops Production in the Tropics. Pp.267-273.

Srinivas, T. (2009). Economic of Sweet Potato and Marketing. In: Loebenstein G. and Thohapilly, G. (eds) Spring Science Business Media. B.V. 2009, 247-436.

Anonymous (2003). Raw Material Research and Development Council (RMRDC). Root and Tuber crops, Annual report, 2002.

Baybutt, R.C. and L. Molteni (2000). A vitamin A deficiency injuries lung and liver parenchyma and impairs function of rat type II Pneumocytes. *J. Nutr*. 130 (5): 65-159.

CACC (2003). Central Agricultural Census Commission. Ethiopian Agricultural Sample Enumeration, 2001/02 (1994 EC): Report on the Preliminary result of area, production and yield of temporary crops. (mether season, private peasant holdings) part 1.

Bengie, P.G. (2005). Sweet potato contains anti-aging nutrients. http://www. still.dost.gov/ph/snypost/frames/jantomaro5/pg31-sweet.

CGIAR 2001. Sweet potatoes: CGIAR research http://www.cgiar. org/research/res sweet p.html.

Zhitian, Z. and Harold, C. (2001). Trypsin inhibitor in vegetative tissue of sweet potato plants and its response to heat diet. *Journal of the Society of Food and Agriculture* **81**: 1358 – 1363.

Abaza, R.H., Blake, J.K. and Fisher, E.J. (1998). Oxalate determination: analytical Problems encountered with certain plant species. *Journal Association of Official Analytical Chemists*, **5**:963 – 967.

Omoregie, E., Igoche, L., Ojobe, T.O., Absalom, K.V. and Onusir, B.C. (2009). Effect of varying levels of sweet potato (*Ipomoea batatas*) peels on growth, feed utilization and some biochemical responses of the Cichlid (*Oreochromis niloticus*). **9**(2) http//www.ajfand.net/ issue 23/PDFs/Omoreige 2165. Pdf retrieved on 04/1/2009.

Etchu, K.A. and Egbunike, G.N. (2000). Assessment of the sugar/starch content of processed sweet potato for poultry nutrition. *Proceedings of the 6th Annual Conference of the Animal Science Association of Nigeria* (ASAN), Sept. 17th – 19th, University of Maiduguri, Nigeria. Pp. 72 – 73.

NPC (2006). National Population Commission. National population census report. Census 2006. Abuja, Nigeria.

Edwin, A.U., A. L. Ahmed, and O.M. Adamu (2014). Full paper in Environmental Dynamics and Sustainable power system infrastructure on the Zamfara plains: A

longitudinal assessment. Department of Engineering Technology. Federal Polytechnic Kaura Namoda, Nigeria.

Dangusau, A.M. (1998). Who is who in Zamfara State? Mega press Limited, Kaduna, Nigeria, Pp. 1-3.

Oluyemi, J.A. and F.A. Robert (2000). Poultry Production in Warm-Wet Climates. 2nd edition Macmillan publisher, London, pp 15-200.

AOAC (1991). Association of Analytical Chemist. Official method of Analysis (15th edition). Arlington V.A.

SAS (1996) Statistical Analysis System. SAS User's guides: Statistics, SAS Institute Inc cary.

Akinmutimi, A.H. and Osuagwu, C.C. (2008). Response of weaner rabbits fed graded levels of sweet potato meal in place of maize-based diet. *Pakistan Journal of Nutrition* **7**(5): 705-709

Dominguez, P.L. (1990). Feeding of sweet potato to monogastrics in: roots, tubers, plantains and bananas in animal feedings, proceedings of the FAO expert consultation held in CIAT, Cali, Columbia, 21-25 January, Pp.81-98.

Noblet, J., Fortuna, H., Upire, C. and Dubois, S. (1990). Valuer nutritinnelle de treize matieres presmieres energie degistible metabolizable elenette. Consequences du choix du systeme energetique. *Journees Recheree Porcine en France.* **22**: 175-184.

Akinmutimi, A.H. and Anakebe, O.C. (2008). Performance of weaner rabbit fed graded levels of yam and sweet potato peel meal in place of maize based diet. *Pakistan Journal of Nutrition* **7**(5): 700-704.

Jiwuba, P.C., E. Dauda, L.C. Ezenwaka and C.J. Eluagu (2016). Replacement Value of Maize with Sweet Potato (*Ipomoea batatas*) Root Meal on Growth Performance and Haematological Characteristics of Broiler Starter Birds. Archives of Current Research International 5(3): 1-7, 2016. Article no. ACRI.27951

Maphosa, T., K.T. Gunduza, J. Kusina, A. Mutungamiri (2003). Evaluation of sweet potato tuber (*Ipomoea batatas* L.) as a feed ingradient in broiler chickens diets. Livestock Research for Rural Development, 15(1).

Ayuk, E.A. (2004). Effects of sweet potato meal on the growth rate of broilers. Livestock Research for Rural Development 16(73).

Akinmutimi, A.H., Obioha, A. and Nebechuwu, S.C. (2008). Response of grower rabbits fed graded levels of inclusion of *Gomphrena cellosioides* Leaf Meal. *Proceedings of the 13th Annual Conference of the Animal Science Association of Nigeria* (ASAN), Sept. 15th – 19th A.B.U, Zaria, Nigeria. Pp. 418 – 421.

Banser, J.T., Fomunyan, D.K., Pone, E.N. and Panigrahis (2000). Effect of meals of sweet potato and cassava varieties formulated with soya meal or cotton seed on broiler production. *African Journal of Technology* 54:50-57.

Tewe, O.O. (1991). Sweet potato utilization in poultry diets, tropical root crops. A developing economy editors: Olori, F. and Halin, S.K. in proceedings of the 9th symposium of the International society for tropical root crops. Accra, Ghana Pp. 426-435.

Ravindran, V. and Sivakanesan, R. (1996). Replacement of maize with sweet potato (*Ipomoea batatas* L.) tuber meal in broiler diets *British poultry science* 37(1):96-101.