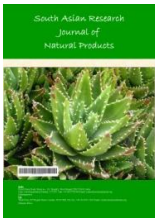

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Study of the Impact of Sweet Potato (*Ipomea batatas*) Meal as a Source of Energy in the Diets of Broilers at Starter and Finisher Stages of Growth in Zamfara State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author ABA designed the study, performed the statistical analysis. Author MSS wrote the protocol and wrote the first draft of the manuscript. Authors MSS and MMI managed the analysis of the study. Author AYK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted to determine the impact of feeding sweet potato meal to broilers. A total of two hundred and fifty (250) day old broilers of Abore acres 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), 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). Data on feed intake, water intake, mortality, feed conversion ratio and body weight gain were recorded. The proximate analysis of the feed samples and sweet potato meal were carried out. The data collected

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at both starter and finisher were subjected to Analysis of Variance (ANOVA) using SAS statistical package. The results recorded at both starter and finisher stages indicated that, there was significant difference (P<0.05) on body weight gain and feed conversion ratio while there was no significant difference (P>0.05) on feed intake, water intake and mortality.. It could be concluded from the results of the study that, control diet and 50% level of inclusion are better for broiler starters and finishers respectively.

Keywords: Sweet potato meal; abore care; data; starter; broilers and significance.

1. INTRODUCTION

The poultry industry plays a significant role in national economic development. According to [1] about 10% of the Nigerian population is engaged in poultry production mostly on subsistence and small/medium scale. In Nigeria, the poultry industry contributed 29,600 metric tons of meat and 250,000 metric tons of eggs in the year 1986 [2]. Despite this, there is persistent short supply of animal protein for the populace as a result of accelerated increase in human population which put pressure on every form of food supply [3]. The population of Nigeria was estimated to be 142 million (NPC, 2006). This large population needs properly balanced diet to avoid malnutrition, which has been the bane of healthy livelihood, mainly as a result of shortages in agricultural product supply. In order to achieve self-sufficiency and economic advancement, the country must be able to feed its population with adequate and nutritionally balanced diets.

Protein is one of the classes of food that is needed by both man and animals to promote healthy growth at all stages of life. Most often, the level of protein intake by the populace is used as a yardstick in assessing the nutritional status of the society. Poultry meat and eggs are high quality sources of protein [4]. Poultry has also been identified as one of the short cycle and highly prolific animal species that could be used to increase animal protein out-put, therefore developing the industry is one of the fastest means of bridging the protein deficiency gap in the country [5]; [6]. According to [7] poultry species are efficient converters of feed to meat and eggs; with no cultural or religious taboo against the consumption of its products, eggs and poultry meat. Nigeria is among the least consumers of animal protein in the world, while North America, Western and Eastern Europe consume 66, 39 and 33g/head/day of animal protein respectively, the average consumption value for Nigerians was estimated at 7.5g/head/day [8]. This is by far below the recommended 35g/head/day by the Food and Agriculture Organization [9]. This may be due to the fact that, animal protein is usually very expensive as a result of high cost of livestock feed. The acute shortage of animal protein and high cost of animal products in our society has stimulated research interests aimed at reducing feed cost and the use of alternative feed stuffs. The low animal protein consumption in Nigeria is a reflection of the poor state of the Nigerian livestock industry which has continued to show discouragingly slow rate of growth [10].

Improvement of poultry production is considered as an assured means of alleviating the problem of acute shortage of animal protein [11]. The sector has assumed greater importance in generating employment opportunities and improving animal production in Nigeria [12]. Most African diets (including Nigerians) are deficient in animal protein, which results in poor growth as well as reduced immunity against diseases and this could result in death particularly among children [13]. To increase protein intake in Nigeria, there is urgent need to increase broiler production at house hold and commercial scales [14]. However, feed problems have been the major hindrance to the growth of the poultry industry in Nigeria. 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 [15]. All over the globe, poultry meat and eggs are preferred to other kinds of animal food products for a variety of reasons.

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 [16]. 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 [17]. 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 [18]. 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 [19]. 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.

1.1 Objectives of the Study

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

Specifically, the study attempts to:

i. Assess the nutrients composition of sweet potato
ii. Determine the performance characteristics of broilers fed graded levels of sweet potato meal as source of energy at both the starter and finisher stages

2. MATERIALS AND METHODS

2.1 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 kilometres with an estimated population of 3,259,846 people [4]. It is located between Latitude 12^0 09^1 15'' N and Longitude 06^0 40^1 0'' E [20]. 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 [21]. The maximum temperature of the area is 41^0c has been reported in April and minimum of 13.2^0c in January while the relative humidity varies from 20 to 72% in the morning and from 7.5 to 63% in the afternoon [21].

2.2 Sources of Experimental Materials

Fresh white sweet potatoes were purchased in bulk from local markets. The potato (both tubers and the 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. (as presented at Table 1 and Table 2)

2.3 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 feed 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.

2.4 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 [8].

2.5 Data Collection

The data collected during the trial include: daily feed intake, daily water intake, weekly body weight gain and mortality. Feed conversion ratio was calculated from the records of feed intake and body weight gain. Daily feed intake was recorded by subtracting feed left over from the quantity of feed given. Similarly daily water intake was recorded using the same procedure for the feed intake. Weight gain was recorded on weekly basis by subtracting previous body weight from the current live weight for each week, average daily gain was calculated. Mortality was recorded as it occurred.

2.6 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 [22] methods.

2.7 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 [23].

3. RESULTS AND DISCUSSION

3.1 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 Tables 1, 2 and 3 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 [24]. However the value was higher than the value (89.60%) reported by [25]. Crude protein (CP) value for sweet potato was 3.55%. The value obtained in this study was lower than 6.40 reported by [26]. The total Ash value (3.75%) was close to the values of 3.1 and 3.2% reported by [27] and [28] respectively. Crude fibre (CF) level was 1.49 which is higher compared to values 0.30 and 0.36% reported by [27] and [29]. Metabolizable energy value was (3089.8) kcal/kg. The value obtained in this study was higher than the value 2899.70 reported by [30].

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.

3.2 Performance of Broilers Fed Graded Levels of Potato Meal at Starter Phase

The performance characteristics of broilers fed graded levels of sweet potato meal at starter phase (0-4 weeks old) are shown in Table 6.

From the results of the study (Table 6.), initial body weight, average feed intake (g/b/d) and average water intake (ml/b/d) were not affected ($P>0.05$) significantly by the inclusion levels of sweet potatoes. However, average final weight gain of the starter chicks was significantly ($P<0.05$) better for the chicks fed the control diet (zero sweet potato). Chicks for the sweet potato replaced diet at 25% levels recorded better weight gain when compared to those for 100% replaced sweet potato with maize. Chicks for 50 and 100% replacement values were not significantly ($P>0.05$) different when compared with those fed 100% sweet potato. Feed conversion ratio of broiler starters fed the control diet (0% sweet potato) was better ($P<0.05$) compared to those for diets 2, 3, 4 and 5. The mortality of chicks for all treatment diets were similar ($P>0.05$).

3.3 Performance of Broilers Fed Graded Levels of Potato Meal at Finisher Phase

The performance characteristics of broilers fed graded levels of sweet potato meal at finisher phase (5-8 weeks old) are shown in Table 7.

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, Pantothenic acid, 7.0mg, Mg 1000mg; Cu, 8.0mg, Co, 0.45mg and Se, 0.1mg per kg of diet; SPM= Sweet Potato Meal*

From the results of the study (Table 7), initial body weight, average feed intake (g/b/d) and average water intake (ml/b/d) were not affected (P>0.05) significantly by the inclusion levels of sweet potatoes. However, average final weight gain of the finisher chicks was significantly (P<0.05) better for the chicks fed the control diet (zero sweet potato). Chicks for the sweet potato replaced diet at 25 and 50% levels recorded better weight gain when compared to those for 75 and 100% replaced sweet potato with maize. Chicks for 25 and 50% replacement value were not significantly (P>0.05) different when compared with those fed 75 and 100% sweet potato. Similarly, chicks for 75 and 100% replacement values were not significantly (P>0.05) different even though they have low values when compared with other treatment diets. Feed conversion ratio of broiler finishers fed the control diet (0% sweet potato) was better (P<0.05) compared to those for diets 2, 3, 4 and 5. The mortality of chicks for all treatment diets were similar (P>0.05).

3.4 Feed Consumption of Experimental Broiler Birds from 0-8 Weeks of Age

Following the Study conducted to evaluate the effect of sweet potato meal on the performance of broilers at both starter and finisher phases. It was observed that, the non-significant effects on feed intake between the treatments indicated that, birds could utilize sweet potato meal without any adverse effects. This could be due to the fact that, sweet potato contains high levels of sucrose and its laxative effect. This non-significant effect contradicted the report of [31] who reported increased feed intake linearly with increasing dietary sweet potato meal. It also contradicted the report of [32] who reported that feed intake increases with increasing levels of dietary potato meals in the diet. Even though the feed intake was not affected significantly, the trend of the intake did not follow any regular pattern (decreasing or increasing) as shown in the results Table 6. Researchers such as [33] and [34] had all reported decrease in feed intake of chicks with increasing levels of sweet potatoes in the diet. [34] Attributed low intake to poor palatability of sweet potatoes to chicks. The results of feed intake in this study also contradicted that of [35] who fed similar levels of 25, 50 and 75% sweet potatoes and reported lower feed intake of chicks. However,[31] reported that feed intake tends to decline as the levels of sweet potato increases in the diet at finisher phase.

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

Table 6. Performance Characteristics of Broiler Starter (0-4 weeks of age)

	0%SPM	25%SPM	50%SPM	75%SPM	100%SPM	
Parameters	T1	T2	T3	T4	T5	SEM
Initial Body Weight (g/b)	56	58	56	56	58	1.72
Total Feed Intake (g/b)	1428.78	1387.27	1505.80	1428.51	1487.58	123.75
Average Feed Intake (g/b/d)	51.02	49.54	53.77	51.01	53.12	4.41
Total Water Intake (ml/b)	2612.09	2491.25	2727.54	2712.76	3030.51	244.02
Average Water Intake (ml/b/d)	93.28	88.97	97.41	96.88	108.23	8.71
Final Body Weight (g/b)	567.84^{a}	467.27^{b}	448.69^{b,c}	410.27^{b,c}	387.44^{c}	19.71
Body Weight Gain (g/b)	511.84^{a}	409.27^{b}	392.69^{b,c}	354.27^{b,c}	329.44^{c}	20.09
Average Daily Gain (g/b/d)	18.28^{a}	14.61^{b}	14.02^{b,c}	12.65^{b,c}	11.76^{c}	0.71
Feed Conversion Ratio	2.85^{a}	3.39^{a,b}	3.82^{b,c}	4.05^{b,c}	4.46^{c}	0.28
Mortality (%)	20.00	20.00	22.00	20.00	24.00	7.39

SEM= Standard Error of Mean; a,b,c means carrying similar superscripts along the same row are not significantly difference (P>0.05)

Table 7. Performance Characteristics of Broiler Finisher (4-8 weeks of age)

Parameters	0%SPM T1	25%SPM T2	50%SPM T3	75%SPM T4	100%SPM T5	SEM
Initial Body Weight (g/b)	459.71	460.57	460.28	460.85	460.28	1.32
Total Feed Intake (g/b)	2988.08	2843.23	3062.92	3153.93	3183.91	148.36
Average Feed Intake (g/b/d)	106.71	101.54	109.39	112.64	113.71	5.29
Total Water Intake (ml/b)	5156.93	5135.81	6003.32	5813.00	6072.28	321.15
Average Water Intake (ml/b/d)	184.17	183.42	214.40	207.60	216.86	11.46
Final Body Weight (g/b)	1512.00^{a}	1421.42^{a,b}	1435.23^{a,b}	1378.00^{b}	1343.00^{b}	43.69
Body Weight Gain (g/b)	1052.28^{a}	960.85^{a,b}	974.95^{a,b}	917.14^{b}	882.71^{b}	43.37
Average Daily Gain (g/b/d)	37.58^{a}	34.31^{a,b}	34.82^{a,b}	32.75^{b}	31.52^{b}	1.54
Feed Conversion Ratio	2.85^{a}	2.98^{a,b}	3.15^{a,b}	3.50^{b,c}	3.58^{b,c}	0.17
Mortality (%)	17.14	8.57	14.28	17.14	20.00	4.69

SEM= Standard Error of Mean; a,b,c means carrying similar superscripts along the same row are not significantly difference (P>0.05)

3.5 Water Consumption of Experimental Broiler Birds from 0-8 weeks of age

Water consumption of the experimental chicks for all treatment diets were not affected at both starter and finisher stages. Even though, birds consumed more water numerically as the levels of sweet potato increases in the diet. This could be due to the amorphous or powdery nature of the sweet potato included in the diets. The dusty nature of the potato meal certainly made the birds to require more water in order to find it easier to ingest and swallow the powdery feed. Watery droppings due to the laxative effect of the potato powder increases the birds demand for water to replace the lost one. This non-significant effect contradicted the report of [36] who fed whole millet in the diets of broilers.

3.6 Body Weight Gain

The significant effects on body weight gain between the treatments indicated that, sweet potato contains high levels of trypsin inhibitor and poor nutrient utilization which may reduce the weight of the birds. The results of the weight gain of broilers at starter phase were in agreement with the reports of [37], [34] and [38] which showed that, birds fed control diet had higher weight gain when compared to those fed 25, 50, 75 and 100% sweet potato. [37] and [39] attributed the poor feed utilization to the presence of anti-nutritional factors like trypsin inhibitors in sweet potato. However, the results of the finisher indicated that, the birds could utilize sweet potato up to 50% without any adverse effect since the body system has already been adopted the diets. The results were in agreement with the report of [40] who replaced between 50-75% of maize in poultry feed with sweet potato meal without any adverse effects on the growth of finisher. However, it contradicted the reports of [34], [38] and [41] who reported that, sweet potato meal could be fed to broilers finisher between 75-80% levels without any adverse effect on the growth performance. Similarly, it

also contradicted the report of [37] who recommended 30% inclusion levels of sweet potato meal in the finisher diets without any adverse effects on the performance.

The results of feed conversion ratio at starter phase concord with the reports of [35] and [34] which showed that, feed conversion ratio deteriorated with increasing levels of sweet potato meal in the diets. However, the results of finisher phase agreed with the reports of [35], [42], [37] and [34] who reported that, the feed conversion ratio at 100% maize replacement was poor than control diet. However, it also contradicted the reports of [43] and [44] which showed that feed conversion ratio was generally poorer for birds on the finisher diets compared to starter diets. [35] Reported that, sweet potato tuber was not efficiently utilized by young chicks of less than two weeks of age. According to [45] broiler chickens fed on sweet potato grew less rapidly than those on a diet containing maize.

3.7 Mortality

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 [35,46] 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 [34] which showed that, mortality increases with increase in sweet potato inclusion levels in the diets beyond 25% for starter.

Mortality obtained was higher than the normal mortality of 5% as recommended by [8] this was due to the outbreak of infectious bursal disease (Gomboro) at the 2^{nd} day of 4^{th} weeks for starter and coccidiosis at 7^{th} weeks for finisher phase.

4. CONCLUSION

From the results of the experiment, control diet revealed 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 and therefore recommended for better productivity.

5. RECOMMENDATIONS

Based on the observations and findings from this study, the following recommendations were offered:

- Further research should be carried out in respect to the level of the processing methods of sweet potato in order to reduce the levels of anti-nutritional factors such as trypsin inhibitor to the bearest minimum.
- Sweet potato meal is useful for broiler production; it will be worthwhile to continue investigations in to the use of this crop for poultry species and other livestock industry.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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