



## GROWTH PERFORMANCE OF BROILER CHICKENS FED DIETARY LEVELS OF SWEET POTATO PEEL MEAL AS REPLACEMENT FOR MAIZE

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### ABSTRACT

The experiment was conducted to evaluate the growth performance of broiler chickens fed graded levels of sweet potato peel meal (SPPM) as replacement for maize. The treatment consists of five diets (0, 25, 50, 75 and 100%) formulated using SPPM as replacement for maize and coded as diets 1, 2, 3, 4 and 5 respectively, in both starter (23% crude protein) and finisher (20% crude protein) phases. Two hundred and twenty five broiler chicks were allotted to the diets in four replicates of fifteen chicks each in a completely randomized design (CRD). The feeding trial lasted for six weeks and feed and water were given *ad libitum*. Data were collected on initial weight, feed intakes and body weight changes. The result obtained at starter phase indicated significant ( $P < 0.001$ ) differences on all the productive performance parameters which include 218.25-364.45g final weight, 141.58-277.45g total weight gain, 6.74-13.21g daily weight gain, 2.19-3.98 feed conversion ratio and 0.25-0.46 feed efficiency) except on initial weight (76.67-87.00) and daily feed intake (24.76-28.90) where no significant difference was observed. The result at finisher phase further showed that, except on daily feed intake (82.54-110.66g) where no significant ( $P > 0.05$ ) difference was observed, a significant ( $P < 0.001$ ) difference was observed at fourth week (218.25-364.45g) and final (608.80-1278.10g) weights. Significant differences were found on total and daily weight gains, feed conversion ratio and feed efficiency with their values ranging between 390.55-913.65, 18.60-43.51, 2.54-4.44 and 0.23-0.39 respectively. Overall phase followed similar trend as in starter phase where all the productive performance parameters were highly ( $P < 0.001$ ) significant with values ranging from 608.80-1278.10 (final weight), 532.13-1191.10 (total weight gain), 12.67-28.36g (daily weight gain), 2.19-3.98 (feed conversion ratio) and 0.23-0.41 (feed efficiency) except on initial weight (76.67-87.00) and daily feed intake (53.66-69.78). However, the best value of feed conversion ratio was recorded on diet T1 (2.46), followed by diet T2 (3.01) while diet T3, T4 and T5 were statistically similar. It was concluded that SPPM can replace maize at 25% level in the diets of broiler chickens at both starter and finisher phase without affecting growth performance and is recommended for broiler chickens production in the study area.

**Keywords:** Productive, Performance, Broiler, Diets

### INTRODUCTION

Poultry is one of the livestock industries that offers the highest turnover and quicker returns on investment either in small, medium or largescale production (Agubosi *et al.*, 2021). Recently, many countries in the world, including Nigeria suffer severe shortage of feed materials especially energy and protein sources (cereals) due to competition between humans, livestock and industries. Maize grain is the main and most conventional energy source in poultry diets (Wala'a and Mashhadani, 2023). The prices of maize have soared so high in recent times coupled with its scarcity in the market thereby making it no more economical to be used in poultry feed formulation. Continual increase in prices of conventional feedstuffs has necessitated the search for alternatives (Agubosi *et al.*, 2021). Sweet potato (*Ipomoea batatas*)



is produced in large quantities in Nigeria and form important energy source for human and livestock feeding. The peels from the processing of these roots are readily available at cheap or no costs in many parts of the country because they have limited or no human food value. Sweet potato peel meal (SPPM) is high in energy but low in protein (Diarra *et al.*, 2012). Although SPPM have been used singly to replace part of dietary maize, replacement levels have not been high in broiler chickens' diets. The study therefore aimed to evaluate the growth performance of broiler chickens fed graded levels of sweet potato peel meal (SPPM) as replacement for maize.

## **MATERIALS AND METHODS**

### **Experimental Site**

The study was conducted at the Abubakar Tafawa Balewa University Teaching and Research Farm Bauchi between March and April, 2024. Bauchi town is located on Latitudes 10°22'N and 11°55'N and Longitudes 09°48'E and 10°10'E respectively (Anon., 2018). Bauchi State occupies a total land area of 49,119km<sup>2</sup> representing about 5.3% of Nigeria's land mass and is located between Latitudes 9°3' and 12°3' North and Longitudes 8°50' and 11°0' East (Anon., 2020). Bauchi State is bordered by seven states, Kano and Jigawa to the North, Taraba and Plateau to the South, Gombe and Yobe to the East and Kaduna to the West. Bauchi climate is characterized by a well-defined rainy season (June – October) and dry season (November – May). The total mean annual rainfall in the state is 700-900 mm for the Northern zone, 690-1031 mm for central zone and 900 – 1300 mm for the western zone (BASDP, 2023). The mean temperature ranges between 19.15°C. The highest temperature is observed in the months of March, April and May, while the lowest is in the months of January and December every year. Highest relative humidity of 99% is observed in August and the lowest of 57% in February (Anonymous, 1999).

### **Experimental Diets**

Five (5) diets were formulated for both starter (23%CP) and finisher (20%CP) phases (Tables 1 and 2) in which SPPM replaced maize at 0, 25, 50, 75 and 100% levels coded as diets 1, 2, 3, 4 and 5 respectively. Other ingredients used in formulating the diets include, wheat offal, full fat soya beans, fishmeal, bone meal, limestone, common salt, palm oil, lysine, methionine and mineral-vitamin premix. Percentage composition and calculated analysis of the experimental diets for starter and finisher phases are presented in Tables 1 and 2.



**Table 1:** Percentage Compositions of Starter Diets Containing Graded Level of Sweet Potato Peel Meal as Replacement for Maize (1– 3 weeks)

Ingredients	T1(0%)	T2(25%)	T3(50%)	T4(75%)	T5(100%)
Maize	45.00	33.75	22.50	11.25	0.00
SPPM	0.00	11.25	22.50	33.75	45.00
FFSB	36.50	36.50	36.50	36.50	36.50
Wheat offal	9.50	9.50	9.50	9.50	9.50
Fish meal	4.00	4.00	4.00	4.00	4.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Limestone	1.50	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
<b>Calculated Analysis</b>					
Crude prot. (%)	23.00	23.00	23.00	23.00	23.00
Crude fibre (%)	3.73	5.67	7.59	9.53	11.46
ME (Kcal/kg)	2986.70	2891.02	2795.35	2799.67	2804.00

SPPM = Sweet Potato Peel Meal, FFSBM = Full Fat Soya Bean, ME = Metabolizable Energy.

**Table 2:** Percentages and Proximate Compositions of Finisher Diets Containing Graded Levels of Sweet Potato Peel Meal as Replacement for Mazie (3 – 6 weeks)

Ingredients	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	51.20	38.40	25.60	12.80	0.00
SPPM	0.00	12.80	25.60	38.40	51.20
FFSB	25.60	25.60	25.60	25.60	25.60
Wheat offal	14.00	14.00	14.00	14.00	14.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Limestone	1.50	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
<b>Calculated Analysis</b>					
Crude prot. (%)	20.00	20.00	20.00	20.00	20.00
Crude fibre (%)	3.63	5.83	8.03	10.23	11.24
ME (Kcal/kg)	2868.10	2809.24	2800.38	2791.53	2782.67

SPPM = Sweet Potato Peel Meal, FFSBM = Full Fat Soya Bean, ME = Metabolizable Energy.



### **Experimental Birds and Their Management**

Two hundred and twenty-five (225) one week old broiler chicks were randomly allotted to the five diets in three replicates of 15 chicks each in a completely randomized design. Experimental feeds and water were given *ad libitum* and the feeding trial lasted for six weeks (3 weeks of starter and finisher each). Initial weights of the birds were recorded at the commencement of the feeding trial. Feed intake (FI) was taken on daily basis and body weight changes were recorded weekly.

### **Data Collection**

#### **Feed intake**

Daily feed intake was determined by the difference between the left-over and quantity of feed offered. Adequate measures were taken to safeguard against spillage and related wastages.

$$FI (g) = \text{Quantity of feed given} - \text{left over}$$

#### **Body weight changes**

Number of birds and their weights were taken at the beginning of the experiment and thereafter on weekly basis. The current week body weight minus the previous week body weight gives the body weight gained during the week.

$$DWG (g) = \text{Final weight} - \text{initial weight}$$

#### **Feed conversion ratio/Feed efficiency**

Feed Conversion Ratio (FCR) was determined by the relationship between feed intake and body weight gain.

$$FCR = \frac{\text{Feed intake}}{\text{Weight gain}} \quad FE = \frac{\text{Weight gain}}{\text{Feed intake}}$$

#### **Data Analysis**

All data collected were subjected to analysis of variance (ANOVA) using SPSS (2.0) and significantly different treatment means were separated using Duncan's Multiple Range Test (DMRT).

## **RESULTS AND DISCUSSION**

The result of growth performance at starter phase of broiler chickens is presented in Tables 3, 4 and 5. The result obtained at starter phase indicated a significant ( $P < 0.001$ ) effects of the treatments on all the productive performance parameters (218.25-364.45g FW, 141.58-277.45g TWG, 6.74-13.21g DWG, 2.19-3.98 FCR and 0.25-0.46 FE) except on initial weight (76.67-87.00g) and daily feed intake (24.76-28.90g) where no significant ( $P > 0.05$ ) effects of the treatments was observed. This result of this study agrees with the findings of Aberra *et al.* (2017) who fed broiler chickens diets containing graded levels of sweet potato leaf meal on growth performance and obtained significant ( $P < 0.001$ ) improvement in growth and economic parameters but slightly differs with the findings of Akintomide *et al.* (2021) who reported a significant ( $P < 0.01$ ) effects when fed broiler chickens diets containing sweet potato leaf meal on growth, haematology, meat quality and improvement in growth. At the finisher phase however, only daily feed intake (82.54-110.66g) was found to be not significantly ( $P > 0.05$ ) affected but highly significant ( $P < 0.001$ ) on finisher initial (218.25-364.45g) and final (608.80-1278.10g) weights. The result further revealed that, significant differences were found on TWG, DWG, FCR and FE with their values ranging between 390.55-913.65, 18.60-43.51, 2.54-4.44 and 0.23-0.39 respectively. Results at the overall phase followed similar trend as in starter phase where all the productive parameters were significantly ( $P < 0.001$ ) affected with values of FW (608.80-1278.10g), TWG (532.13-1191.10g), DWG (12.67-28.36g), FCR (2.26-4.32) and FE (0.23-0.41) while IW (76.67-87.00g) and DFI (53.66-69.78g) where not affected by the treatments as indicated by the result. All the results on the overall phase differ with the findings of Wala'a and Mashhadani (2023). However, the best value of FCR was recorded on



T1 (2.46), followed by T2 (3.01) while T3, T4, and T5 were statistically similar. The mortality rate in all the phases were within the accepted range of 0-5% for good management practices and safety of diets.

**Table 3:** Performance of Broiler Chickens Fed Dietary Levels of Sweet Potato Peel Meal at the Starter Phase (1 – 3 weeks)

Parameters	T1(0%)	T2(25%)	T3(50%)	T4(75%)	T5(100%)	SEM
IW (g)	87.00	80.00	80.00	76.67	76.67	0.15 <sup>NS</sup>
4 <sup>th</sup> WWt(g)	364.45 <sup>a</sup>	324.45 <sup>ab</sup>	247.22 <sup>bc</sup>	226.67 <sup>bc</sup>	218.25 <sup>c</sup>	15.95 <sup>***</sup>
TWG(g)	277.45 <sup>a</sup>	244.45 <sup>ab</sup>	167.22 <sup>b</sup>	150.00 <sup>b</sup>	141.58 <sup>b</sup>	15.95 <sup>***</sup>
DWG(g)	13.21 <sup>a</sup>	11.64 <sup>ab</sup>	7.14 <sup>b</sup>	6.74 <sup>b</sup>	7.22 <sup>b</sup>	0.57 <sup>***</sup>
DFI(g)	28.90	27.19	25.48	24.76	26.85	1.34 <sup>NS</sup>
FCR	2.19 <sup>a</sup>	2.34 <sup>b</sup>	3.20 <sup>ab</sup>	3.46 <sup>ab</sup>	3.98 <sup>c</sup>	0.25 <sup>***</sup>
FE	0.46 <sup>a</sup>	0.43 <sup>a</sup>	0.31 <sup>ab</sup>	0.29 <sup>ab</sup>	0.25 <sup>b</sup>	0.02 <sup>***</sup>
Mort. (No)	0	0	1	0	0	-

a, b, c = Means within the same row bearing different superscripts differ significantly ( $P < 0.05$ )  
 \*\*\*= highly significant ( $P < 0.001$ ), \*= significant ( $P < 0.05$ ), SEM= Standard Error of the Mean  
 NS= Not Significant ( $P > 0.05$ ). SPPM=Sweet Potato Peel Meal, AIW= Average Initial Weight.  
 AFWG= Average Final Weight, ATWG= Average Total Weight Gain ADWG= Average Daily Weight Gain, ADFI= Average Daily Feed Intake, FCR= Feed Conversion Ratio, FE= Feed Efficiency, MORT. = Mortality.

**Table 4:** Performance of Broiler Chicken Fed Dietary Levels of Sweet Potato Peel Meal at the Finisher Phase (4 – 6 weeks)

Parameters	T1(0%)	T2(25%)	T3(50%)	T4(75%)	T5(100%)	SEM
IW (g)	364.45 <sup>a</sup>	324.45 <sup>ab</sup>	247.22 <sup>bc</sup>	226.67 <sup>bc</sup>	218.25 <sup>c</sup>	15.95 <sup>***</sup>
4 <sup>th</sup> WWt(g)	1278.10 <sup>a</sup>	960.00 <sup>b</sup>	654.10 <sup>bc</sup>	721.00 <sup>b</sup>	608.80 <sup>c</sup>	80.66 <sup>***</sup>
TWG(g)	913.65 <sup>a</sup>	635.55 <sup>ab</sup>	406.88 <sup>b</sup>	494.33 <sup>b</sup>	390.55 <sup>b</sup>	81.50 <sup>**</sup>
DWG(g)	43.51 <sup>a</sup>	30.26 <sup>ab</sup>	19.38 <sup>b</sup>	23.54 <sup>b</sup>	18.60 <sup>b</sup>	3.02 <sup>**</sup>
DFI(g)	110.66	98.83	85.12	87.89	82.54	13.07 <sup>NS</sup>
FCR	2.54 <sup>a</sup>	3.27 <sup>b</sup>	4.39 <sup>c</sup>	3.73 <sup>ab</sup>	4.44 <sup>c</sup>	0.49 <sup>**</sup>
FE	0.39 <sup>a</sup>	0.31 <sup>ab</sup>	0.23 <sup>b</sup>	0.27 <sup>ab</sup>	0.23 <sup>b</sup>	0.02 <sup>**</sup>
Mort. (No)	1	0	0	0	0	0

a,b,c = Means within the same row bearing different superscripts differ significantly ( $P < 0.05$ ),  
 \*\*\*= highly significant ( $P < 0.001$ ), \*= significant ( $P < 0.05$ ), SEM= Standard Error of the Mean,  
 NS= Not Significant ( $P > 0.05$ ), SPPM=Sweet Potato Peel Meal, Start. WT= Starter Average Weight, AFWG= Average Final Weight, ATWG= Average Total Weight Gain, ADWG= Average Daily Weight Gain, ADFI= Average Daily Feed Intake, FCR= Feed Conversion Ratio, FE= Feed Efficiency, Mort. = Mortality.





**Table 5:** Overall Performance of Broiler Chickens Fed Dietary Levels of Sweet Potato Peel Meal (1 – 6 weeks)

Parameters	T1(0%)	T2(25%)	T3(50%)	T4(75%)	T5(100%)	SEM
IW (g)	87.00	80.00	80.00	76.67	76.67	7.96 <sup>NS</sup>
FW(g)	1278.10 <sup>a</sup>	960.00 <sup>ab</sup>	654.10 <sup>b</sup>	721.00 <sup>b</sup>	608.80 <sup>b</sup>	41.46 <sup>***</sup>
TWG(g)	1191.10 <sup>a</sup>	880.00 <sup>ab</sup>	574.10 <sup>b</sup>	644.33 <sup>b</sup>	532.13 <sup>b</sup>	40.33 <sup>***</sup>
DWG(g)	28.36 <sup>a</sup>	20.95 <sup>ab</sup>	13.67 <sup>b</sup>	15.34 <sup>b</sup>	12.67 <sup>b</sup>	1.44 <sup>***</sup>
DFI(g)	69.78	63.01	55.30	53.66	54.69	6.42 <sup>NS</sup>
FCR	2.46 <sup>a</sup>	3.01 <sup>ab</sup>	4.05 <sup>ab</sup>	3.50 <sup>c</sup>	4.32 <sup>c</sup>	0.29 <sup>***</sup>
FE	0.41 <sup>a</sup>	0.33 <sup>ab</sup>	0.25 <sup>b</sup>	0.29 <sup>ab</sup>	0.23 <sup>b</sup>	0.02 <sup>***</sup>
Mort. (No)	1	0	1	0	0	–

a,b,c = Means within the same row bearing different superscripts differ significantly, \*\*\*= highly significant ( $P<0.001$ ), \*= significant ( $P<0.05$ ), SEM= Standard Error of the Mean, NS= Not Significant ( $P>0.05$ ), SPPM=Sweet Potato Peel Meal, IW= Initial Weight, FWG= Final Weight Gain, TWG= Total Weight Gain, DWG= Daily Weight Gain, DFI= Daily Feed Intake, FCR= Feed Conversion Ratio, FE= Feed Efficiency, Mort. = Mortality.

## CONCLUSION AND RECOMMENDATION

Based on the findings of this research, it can be concluded that sweet potato peel meal (SPPM) can replace maize at 25% level in the diets of broiler chickens without affecting growth performance and is therefore recommended for broiler chicken production in the study area.

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