



**REPLACEMENT VALUE OF SUPER SOSAT MILLET FOR MAIZE IN GROUNDNUT  
CAKE BASED DIETS ON THE GROWTH PERFORMANCE AND  
CARCASS QUALITY OF BROILER CHICKENS**

<sup>1</sup>Bello, A. T., <sup>2</sup>Abubakar, M., <sup>2</sup>Doma, U. D., <sup>3</sup>Sani, U. M., <sup>4</sup>Garba, S. I.,  
<sup>4</sup>Alhassan, N. M. and <sup>4</sup>Bot, M.H.

<sup>1</sup>National Veterinary Research Institute, NVRI, Vom, Plateau state

<sup>2</sup>Department of Animal Production, Abubakar Tafawa Balewa University, Bauchi, Nigeria

<sup>3</sup>Department of Animal Science, Federal University of Lafia, Nasarawa state, Nigeria

<sup>4</sup>Federal College of Animal Health and Production Technology, Vom, Plateau state

**Corresponding Author's Email:** sirajowase@gmail.com, **GSM:** 08036071717

**ABSTRACT**

The experiment was conducted to evaluate the response of broiler chickens fed Super SOSAT (SSM) pearl millet to replace maize as a source of energy in groundnut cake based broiler chickens diets. Three hundred broiler chicks were randomly allotted to five dietary treatments in replicates of three containing 20 birds each in a completely randomized design. In the trial, Super SOSAT millet replaced maize at 0, 25, 50, 75 and 100% levels. Feed and water were served *ad lib* and the experiment lasted for 42 days. Results showed that at both the starter and overall phases, no influence of SSM was observed on performance indices. At the starter phase, daily feed intake (DFI) ranged from 77.35g (diet 4) to 86.47g (diet 2), while daily weight gain (DWG) varied from 29.52g (diet 2) to 39.21g (diet 1). At the overall phase, DFI ranged from 105.80 g (diet 4) to 118.43 g (diet 2), while daily weight gain (DWG) varied from 37.46 g (control diet) to 42.30 g (diet 2). Similarly, feed conversion ratio (FCR) ranged between 2.67 (diet 3) and 3.12 on diet 2. However, at the finisher phase DWG and FCR were significantly ( $P<0.05$ ) higher for diets with super SOSAT millet compared to the control. The results of carcass characteristics shows that except for lung weight, head weight and weight of the small intestine, no parameter was significantly ( $P>0.05$ ) influenced treatments. Live weight of birds was between 1.94 kg on diet 1 to 2.14 kg on diet 3, plucked weight from 1.70 kg (diet 1) to 1.87 kg (diets 2 and 3), eviscerated weight from 1.30 to 1.42 kg on diets 1 and 2 respectively. Carcass weight ranged from 1.22 kg (diets 1 and 4) to 1.29 (diet 3), while the birds dressed between 59.14 – 63.78 % on diets 3 and 1 respectively. The cost benefit analysis of broiler chickens fed the experimental diets showed a progressive decrease in overall feed cost per kg gain from ₦348.96 (diet 1) to ₦275.51 (diet 5). Consequently, cost savings increased gradually from ₦24.04 for diet 1 to ₦73.45 for those on diet 5. The results of the current study showed that Super SOSAT millet can completely replace maize in broiler chickens' diets without any deleterious effect on growth performance and carcass characteristics. However, based on the DWG of 40.24g and the least feed cost/kg gain of ₦275.51 for broiler chickens in diet 5 compared to the others, it is recommended for broiler chickens.

**Keywords:** Broiler, Chickens, Millet, Growth, Performance, Carcass

**INTRODUCTION**

Poultry production, especially the broiler chickens, remains one of the dynamic ways of attaining sustainable and rapid production of high quality protein to meet the increasing demand of the Nigerian teeming populace (Obasi, 2020). Similarly, in the face of the current staggering level of youth unemployment in the country, which has the potential to ignite civil unrest and conflicts among masses and between people and government, the poultry industry, through entrepreneurship, can be harnessed for youth empowerment (Ajala *et al.*, 2021). Maize constitutes the principal energy ingredient in poultry diets (Adam and El-Basheir, 2016). However, high cost of conventional feed ingredients, especially maize, occasioned by increasing food-feed-fuel competition has been the greatest challenge bedeviling the industry. The use of millet as an alternative energy source in poultry rations formulation was advanced by many researchers (Adamu *et al.*, 2000; Baurhoo *et al.*, 2011;



Bala *et al.*, 2017; Kawu *et al.*, 2020). Super SOSAT millet is a pearl millet variety developed by the Lake Chad Research Institute, Maiduguri, Nigeria. The variety has a potential yield of 3.0 - 3.5 tonnes/hectare. It is drought resistant and performs well on marginally poor soils (Umar, 2018). Studies have indicated that millet grain could potentially be successfully incorporated into poultry diets (Yunusa *et al.*, 2015; Qaisrani *et al.*, 2018). The protein content of millet, although variable, is higher than maize (Cisse *et al.*, 2017; Yilikal *et al.*, 2018) and the amino acid profile is more balanced than maize (Sullivan *et al.*, 1990; Adeola *et al.*, 1994 and Yilikal *et al.*, 2018). The current study was therefore designed to evaluate the replacement value of Super SOSAT (SSM) pearl millet for maize in groundnut cake based broiler chickens diets.

## **MATERIALS AND METHODS**

### **Experimental Site**

The experiments were conducted at the Poultry Unit, Teaching and Research Farm, Abubakar Tafawa Balewa University, Bauchi. The town, Bauchi, is located within the southern guinea savannah on latitude 10.31 N and longitude 9.84 E. Furthermore, it is 616 metres above sea level characterized by two well-defined seasons; Rainy season (May-October) and dry season (November-April). The average annual rainfall is 1009mm, highest relative humidity 94 % (August) and the lowest 35 % (February). Temperatures are between 13 – 17°C (December – February) and 36 – 37° C (March – April) (World Atlas, 2015). According to ICRISAT (1984), these agrometeorological indices are also favorable for millet cultivation.

### **Management of Experimental Birds**

Three hundred (300) unsexed, day-old, broiler chickens of the *Cobb* strain were purchased from Pieridox hatchery in Jos, Plateau State for the experiment. Two weeks prior to the birds' arrival, the experimental pens were cleaned, washed, disinfected and fumigated. Furthermore, feeders, drinkers and all other necessary equipment were also cleaned. A week after, litter material (wood shavings) were spread in the experimental pens to a floor depth of approximately 3 inches. Adequate heating/lighting facilities were also provided. Brooding, which lasted for a period of 14 days, commenced with the arrival of chicks. Two (2) electric bulbs of 200 watts capacity each, were used to provide the necessary warmth needed in the brooding room. The birds were fed chick mash during this period. They were also given the first dose of IBDV (Gumboro vaccine) at 7 days, followed by an anti-stress drug for two consecutive days. Another vaccine, New Castle Disease Vaccine NCDV (LASOTA) was also administered on the 13<sup>th</sup> day. At the end of this brooding period, the birds were randomly assigned to five dietary treatments in a completely randomized design (CRD). Each treatment was replicated thrice containing 20 birds each giving a total of sixty birds (60) per treatment. Experimental diets and clean drinking water were served *ad libitum* throughout the six-weeks trial period. Birds were also given the second dose of Infectious Bursal Disease vaccine (Gumboro vaccine) (Booster) on the 21<sup>st</sup> day and another one for NCDV a week after. All vaccines and drugs were administered orally. The experiment was conducted in a completely randomized design (CRD).

### **Data Collection**

Feed consumption, weight gain, feed conversion ratio and mortality were the performance parameters monitored during the experiments. Initial live weights of chickens were taken at the commencement of each experiment and thereafter, weights were determined on weekly basis. Values obtained were then used to calculate the daily weight gain (DWG). Daily feed intake was also determined by subtracting the weight of left-over feed from the quantity offered the previous day. However, feed conversion ratio, was calculated. At the end of the finisher phase, thirty birds, two from each replicate, were randomly selected, fasted for 12 hours and slaughtered. The weight of each bird was taken before slaughter. Hot weight of carcasses and internal organs were immediately measured using an electronic balance. The economic analysis of broiler production was calculated to assess the cost-benefit of replacing maize with super sosat millet in groundnut cake based diets of broiler chickens. Accordingly, the following parameters were determined. Feed cost per kilogram of each diet, total cost of feed consumed per bird on each diet, feed cost per kilogram weight gain and

cost savings. The cost of diets (₦/kg) was calculated based on the on-season market prices of major ingredients and the prevailing prices of other ingredients at the time of the experiment.

### Experimental Diets

Five experimental diets for both starter (23 % CP) and finisher (20 %) phases were formulated. Super Sosat Millet (SSM) replaced maize at 0, 25, 50, 75 and 100 % levels, designated as diets 1 (control), 2, 3, 4, and 5 respectively. Groundnut cake was the main plant protein source used in the diets. Broiler starter and finisher diets were fed for 3 weeks each. Ingredients and percentage composition of dietary SSM as replacement for maize are presented in Tables 1 and 2.

**Table 1:** Ingredients Composition (%) and Calculated Analysis of Dietary Levels of Super Sosat Millet as Replacement for Maize in Groudnut Cake Meal-Based Diets Fed to Starter Broiler Chickens (1-3 weeks)

Ingredients	DIETS				
	1	2	3	4	5
Maize	46.80	35.10	23.40	11.70	0.00
Super SOSAT millet	0.00	11.70	23.40	35.10	46.80
Groundnut cake meal	33.40	33.40	33.40	33.40	33.40
Palm oil	3.00	3.00	3.00	3.00	3.00
Wheat Offal	7.00	7.00	7.00	7.00	7.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15	0.15
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
Calculated Analysis (%)					
ME (Kcal/kg)	2893.00	2874.00	2856.00	2839.00	2817.00
Crude Protein	23.00	23.00	23.00	23.00	23.00
Ether Extract	3.30	3.74	4.18	4.69	5.07
Crude Fibre	4.68	4.62	4.56	4.50	4.44
Calcium	1.47	1.47	1.47	1.48	1.48
Phosphorus	0.88	0.88	0.88	0.88	0.88
Methionine	0.45	0.44	0.43	0.43	0.42
Lysine	1.13	1.12	1.12	1.11	1.11

ME; Metabolizable energy

\*Vit/mineral premix supplied/Kg of Diet: Vit. A, 12,500 IU; Vit. D<sub>3</sub>, 2,500 IU; Vit. E, 30 IU; Vit. K, 2.5 mg; Riboflavin, 6 mg; Pantothenic acid, 10 mg; Vit. B, 2 mg; Niacin, 30 mg; Vit. B<sub>12</sub>, 22 mg; Biotin, 0.05 mg; Folic acid, 1 mg; Chlorine chloride, 0.3 mg; Antioxidant, 0.125 mg; Iron, 100 mg; Manganese, 100 mg; Zinc, 100 mg; Iodine, 1.5 mg; Cobalt, 0.5 mg; Selenium, 0.1 mg and Copper 10 mg.

**Table 2:** Ingredients Composition (%) and Calculated Analysis of Dietary Levels of Super Sosat Millet as Replacement for Maize in Groundnut Cake Meal-Based Diets Fed to Finisher Broiler Chickens (4-6 weeks)

Ingredients	DIETS				
	1	2	3	4	5
Maize	51.83	38.87	25.92	12.96	0.00
Super SOSAT millet	0.00	12.96	25.92	38.87	51.83
Groundnut cake meal	20.27	20.27	20.27	20.27	20.27
Palm oil	3.00	3.00	3.00	3.00	3.00
Wheat Offal	15.00	15.00	15.00	15.00	15.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
Calculated Analysis (%)					
ME (Kcal/kg)	2981.00	2967.00	2951.00	2933.00	2914.00
Crude Protein	20.00	20.00	20.00	20.00	20.00
Ether Extract	4.28	4.77	5.27	5.96	6.25
Crude Fibre	4.49	4.43	4.36	4.29	4.23
Calcium	1.46	1.46	1.46	1.47	1.47
Phosphorus	0.92	0.92	0.92	0.92	0.92
Methionine	0.45	0.44	0.43	0.43	0.42
Lysine	1.02	1.02	1.02	1.01	1.01

ME; Metabolizable energy

\*Vit/mineral premix supplied/Kg of Diet: Vit. A, 12,500 IU; Vit. D<sub>3</sub>, 2,500 IU; Vit. E, 30 IU; Vit. K, 2.5 mg; Riboflavin, 6 mg; Pantothenic acid, 10 mg; Vit. B, 2 mg; Niacin, 30 mg; Vit. B<sub>12</sub>, 2.2 mg; Biotin, 0.05 mg; Folic acid, 1 mg; Chlorine chloride, 0.3 mg; Antioxidant, 0.125 mg; Iron, 100 mg; Manganese, 100 mg; Zinc, 100 mg; Iodine, 1.5 mg; Cobalt, 0.5 mg; Selenium, 0.1 mg and Copper 10 mg.

### Experimental Design

The experiment was conducted in a completely randomized design (CRD).

### Statistical Analysis

All data were analyzed by one-way analysis of variance (ANOVA) using the statistical package, SPSS version 23. Differences between treatment means were separated using Duncan's Post Hoc method (Duncan, 1955).

## RESULTS AND DISCUSSION

### Performance of Broiler Chickens Fed Super SOSAT Millet as Replacement for Maize in Groundnut Cake Meal Based Diets

The growth performance of Broiler Chickens fed Super SOSAT Millet (SSM) as replacement for Maize in Groundnut Cake Meal Based Diets is presented in Table 3. At both the starter and overall phases, no influence of SSM was obtained on performance indices. At the starter phase, daily feed intake (DFI) of birds ranged from 77.35g (diet 4) to 86.47g (diet 2), while daily weight gain (DWG) varied from 29.52g (diet 2) to 39.21g (diet 1). At the overall phase, DFI ranged from 105.80 g (diet 4) to 118.43 g (diet 2), while daily weight gain (DWG) varied from 37.46 g (control diet) to 42.30 g (diet 2). Similarly, feed conversion ratio (FCR) ranged between 2.67 (diet 3) and 3.12 on diet 2. However, at the finisher phase DWG and FCR were significantly ( $P < 0.05$ ) higher for diets with super SOSAT millet compared to the control diet. This signifies that super SOSAT millet is equivalent to maize in broiler chicken diets. The results of this study are in agreement with the reports of Kawu (2010) and

Afsharmanesh *et al.* (2016) who reported that broiler chickens fed millet based diets gave higher average body weight than those on diet containing maize. The body weight gain at the finisher phase (37.46 - 42.30g) is similar to the 37.02-42.39g reported by Yakubu *et al.* (2020) for broiler chickens fed graded levels of Super SOSAT millet in diets. Values for daily feed intake and daily weight gain (starter phase) in this study are however higher than 48.42 – 49.05 g and 23.11 – 26.31 g respectively reported by Gidado *et al.* (2020) in broiler chickens fed maize-sorghum based diets supplemented with synthetic enzyme. Feed conversion ratio of birds at the finisher phase correlated strongly with 2.13 – 2.90 obtained by Anyanwu *et al.* (2020) in finisher broiler chickens fed palm kernel cake in partial replacement for maize within a 28-day period.

**Table 3:** Performance of Broiler Chickens fed Super SOSAT Millet as Replacement for Maize in Groundnut Cake Meal Based Diets

Parameter	Diets					SEM
	1	2	3	4	5	
Initial Weight (g)	226.67	233.33	223.33	223.33	233.33	8.03 <sup>NS</sup>
Final Weight (g)	1800	2010	1980	1856.67	1923.33	96.60 <sup>NS</sup>
Body weight at week 3	1050	853.33	930	946.67	920	83.45 <sup>NS</sup>
Total Weight Gain (g)	1573.33	1776.67	1756.67	1633.33	1690	91.52 <sup>NS</sup>
<b>Starter Phase (1-3weeks)</b>						
Daily Feed Intake (g)	82.15	86.47	83.36	77.35	81.6	3.29 <sup>NS</sup>
Daily Weight Gain (g)	39.21	29.52	33.65	34.44	32.7	3.81 <sup>NS</sup>
Feed Conversion Ratio	2.11	3.4	2.48	2.27	2.51	0.46 <sup>NS</sup>
Mortality (Number)	1	0	0	2	1	-
<b>Finisher Phase (4-6 Weeks)</b>						
Daily Feed Intake (g)	132.27	150.38	141.57	134.24	137.59	5.56 <sup>NS</sup>
Daily Weight Gain (g)	35.71 <sup>b</sup>	55.08 <sup>a</sup>	50.00 <sup>ab</sup>	43.33 <sup>ab</sup>	47.78 <sup>ab</sup>	4.78*
Feed Conversion Ratio	3.78 <sup>b</sup>	2.84 <sup>a</sup>	2.85 <sup>a</sup>	3.10 <sup>ab</sup>	2.90 <sup>a</sup>	0.24*
Mortality (Number)	0	0	1	0	0	-
<b>Overall (1-6 Weeks)</b>						
Daily Feed Intake (g)	107.71	118.43	112.46	105.8	109.6	4.06 <sup>NS</sup>
Daily Weight Gain (g)	37.46	42.3	41.83	38.89	40.24	2.18 <sup>NS</sup>
Feed Conversion Ratio	2.95	3.12	2.67	2.68	2.7	0.16 <sup>NS</sup>
Mortality (Number)	1	0	1	2	1	-

<sup>abc</sup>Means bearing different superscripts within the same row differ; \* = (P<0.05); ns= Not significant; SEM = Standard Error of Means

### **Carcass and Organ Characteristics of Broiler Chickens Fed Super SOSAT Millet as Replacement for Maize in Groundnut Cake Meal Based Diets**

Carcass characteristics of broiler chickens fed dietary replacement Super SOSAT millet for maize is shown in Table 4. Except for lung weight, head weight and weight of the small intestine, no parameter was significantly (P>0.05) influenced by the replacement of dietary maize with Super SOSAT millet. This finding disagrees with Kawu *et al.* (2020). Live weight of birds was between 1.94 kg on diet 1 to 2.14 kg on diet 3, plucked weight from 1.70 kg (diet 1) to 1.87 kg (diets 2 and 3), eviscerated weight from 1.30 to 1.42 kg on diets 1 and 2 respectively. Carcass weight also spanned between 1.22 kg (diets 1 and 4) and 1.29 (diet 3) while the birds dressed between 59.14 – 63.78 % on diets 3 and 1 respectively. The values for dressing percentage in this research work are lower than 70.15 - 74.37% reported by Mohammed (2025) for broiler chickens fed Egusi Melon Seed Cake as replacement for Full Fat Soya Bean. Relative weights of organs revealed no significant (p<0.05) differences in leg weight which was between 3.98 % (diet 1) and 4.38 % (diet 4). However, weight of lungs was significantly (P<0.05) higher on diets 2 (0.65%) and 4 (0.62 %) which were statistically same. Birds fed the control diet had lower lung weights (0.48 %). However, those fed diets 3 (0.58 %) and 5 (0.56 %) compared favourably with those on other diets. Head weight as a percentage of live weight, was also higher (P<0.05) for birds fed diet 4 (2.52 %) and lower on those fed diet 3 (1.93 %). Both groups however, did not differ from those on diets 2 (2.31%), 1 (2.32%) and 5 (2.33 %) which

were similar. The cause for significant ( $P < 0.05$ ) increase in relative weights of lungs and head with high levels of SSM in the diet was not very clear. However, the higher small intestinal weights of birds on diets 2 and 3 can be attributed to the higher crude fibre content of SSM. It was also expected that some significant effects of diet would be recorded on relative weights of gizzard due to the higher crude fibre content of SSM, but this was however not so. Kidney weight of birds in this study did not differ significantly among groups. The range was from 0.14 % on diets 3 and 5 weight to 0.20 % on diet 1. Heart weight was from 0.39 to 0.51 % in birds fed diets 1 and 3 respectively. Similarly, weight of gizzard spanned between 2.56 % (diet 5) and 2.81 % (diet 4). A significant ( $P < 0.05$ ) influence of Super SOSAT millet was observed on small intestinal weight of birds. Birds on diet 3 (1.52 %) had heavier small intestines than those fed any of diets 1 (1.19 %), 5 (1.25%) and 4 (1.28 %). However, those on diet 2 did not differ from those on other treatments. There were no significant ( $p < 0.05$ ) differences in the weight of large intestines of broiler chickens fed Super SOSAT millet as replacement for dietary maize. Values obtained ranged from 0.17 % on diet 2 to 0.21 % on diet 5. Relative weight of caeca, 0.05 % (diet 1) to 0.07 % (diets 2 & 4), also did not differ among diets. No significant effect of dietary Super SOSAT was also seen on the relative weight of abdominal fat of the broiler chickens and ranged between 0.905 % (diet 4) to 1.43 % (diet 5). On a similar note, the weight of liver (1.82 – 1.94 %) and that of pancreas (0.12 – 0.16 %), were not influenced by diet.

**Table 4:** Carcass and Organ Characteristics of Broiler Chickens fed Super SOSAT millet as Replacement for Maize in Groundnut Cake Meal Based Diets

Parameters	Diets					SEM
	1	2	3	4	5	
Live Weight (kg)	1.92	2.1	2.14	2.02	2.03	0.10 <sup>NS</sup>
Plucked Weight (kg)	1.7	1.87	1.87	1.79	1.82	0.09 <sup>NS</sup>
Eviscerated Weight (kg)	1.3	1.42	1.39	1.35	1.39	0.08 <sup>NS</sup>
Carcass Weight (kg)	1.22	1.28	1.29	1.22	1.26	0.07 <sup>NS</sup>
Dressing (%)	63.78	60.92	59.14	59.87	60.67	1.49 <sup>NS</sup>
<b>Organ weights expressed as percentage of live weight</b>						
Leg Weight	3.98	4.36	4.01	4.38	4.09	0.24 <sup>NS</sup>
Lung Weight	0.48 <sup>b</sup>	0.65 <sup>a</sup>	0.58 <sup>ab</sup>	0.62 <sup>a</sup>	0.56 <sup>ab</sup>	0.04 <sup>*</sup>
Head Weight	2.32 <sup>ab</sup>	2.31 <sup>ab</sup>	1.93 <sup>b</sup>	2.52 <sup>a</sup>	2.33 <sup>ab</sup>	0.18 <sup>*</sup>
Kidney Weight	0.20	0.15	0.14	0.16	0.14	0.04 <sup>NS</sup>
Heart Weight	0.39	0.46	0.51	0.47	0.46	0.04 <sup>NS</sup>
Gizzard Weight	2.76	2.63	2.61	2.81	2.56	0.16 <sup>NS</sup>
Small Intestine Weight	1.19 <sup>b</sup>	1.35 <sup>ab</sup>	1.52 <sup>a</sup>	1.28 <sup>b</sup>	1.25 <sup>b</sup>	0.08 <sup>*</sup>
Large Intestine Weight	0.2	0.17	0.19	0.2	0.21	0.02 <sup>NS</sup>
Caecal Weight	0.05	0.07	0.06	0.07	0.06	0.00 <sup>NS</sup>
Abdominal Fat Weight	1.46	1.07	1.08	0.9	1.03	0.18 <sup>NS</sup>
Liver Weight	1.83	1.88	1.9	1.82	1.94	0.09 <sup>NS</sup>
Pancreas Weight	0.13	0.13	0.12	0.16	0.13	0.02 <sup>NS</sup>

<sup>ab</sup>Means bearing different superscripts within the same row differ; \* = ( $P < 0.05$ ); ns= Not significant; SEM = Standard Error of Means

### **Cost Benefit of Broiler Chickens Fed Super SOSAT Millet as Replacement for Maize in Groundnut Cake Meal Based Diets**

The cost benefit of broiler chickens fed diets containing Super SOSAT millet is presented in Table 5. On the overall, feed intake of birds was between 4.44 and 4.97 kg for birds on diets 4 and 2 respectively. Feed cost (₦) decreased from ₦121.21 for diet 1 to ₦101.22 for those on diet 5. Total feed cost varied between ₦465.61 for diet 5 to ₦578.31 for birds on diet 2, while total weight gain of birds ranged from 1.57 kg for the group on the control to 1.78 kg for those on diet 2. A progressive decrease in overall feed cost per kg gain from ₦348.96 (diet 1) to ₦275.51 (diet 5) was obtained in this study. Consequently, cost savings increased gradually from ₦24.04 for diet 1 to ₦73.45 for those



on diet 5. There was a marked and continuous reduction in feed cost per kg with increased SSM in the diet. This was due to the lower price of super SOSAT millet compared to maize. There was however no definite trend in total feed intake of birds and total weight gain. This was perhaps the reason why feed cost per kg gain also did not assume any definite trend. Be that as it may, on the overall, feed cost per kg gain appeared to be lower on SSM based diets and cost was saved thereon. The values of feed cost per kg gain obtained in the current study (₦348.96 - ₦275.51) were less than those (₦351.06 - ₦433.98) reported by Lawal *et al.* (2022) for broiler chickens fed diets containing soya bean residue.

**Table 5: Cost Benefits of Broiler Chickens Fed Super SOSAT Millet as Replacement for Maize in Groundnut Cake Meal Based Diets**

Parameter	DIETS				
	1	2	3	4	5
<b>Starter phase (1 – 3 wks)</b>					
Total feed intake (kg)	1.73	1.82	1.75	1.62	1.72
Feed cost (₦ /kg)	102.55	99.46	96.31	92.01	89.23
Total feed cost (₦)	177.41	181.02	168.54	152.30	156.92
Total weight gain (kg)	0.82	0.62	0.71	0.72	0.69
Feed cost per kg gain (₦)	216.35	291.97	237.38	211.53	227.42
Cost saving (₦)	-	-75.62	-21.03	4.82	-11.07
<b>Finisher phase (4 – 6 wks)</b>					
Total feed intake (kg)	2.78	3.16	2.97	2.82	2.89
Feed cost (₦ /kg)	139.87	133.26	123.85	120.95	113.21
Total feed cost (₦)	388.84	421.10	367.84	341.08	327.18
Total weight gain (kg)	0.75	1.16	1.05	0.91	1.00
Feed cost per kg gain (₦)	518.45	363.02	350.32	374.81	327.18
Cost saving (₦)	-	155.43	168.13	143.64	191.27
<b>Overall phase (1 – 6 wks)</b>					
Total feed intake (kg)	4.52	4.97	4.72	4.44	4.60
Feed cost (₦ /kg)	121.21	116.36	110.08	106.48	101.22
Total feed cost (₦)	547.87	578.31	519.57	472.77	465.61
Total weight gain (kg)	1.57	1.78	1.76	1.63	1.69
Feed cost/kg gain (₦)	348.96	324.89	295.21	289.74	275.51
Cost saving (₦)	-	24.07	53.75	59.22	73.45

## CONCLUSION AND RECOMMENDATION

In conclusion, results of the current study showed that Super SOSAT millet can completely replace maize in broiler chickens' diets without any deleterious effect on growth performance and carcass characteristics. However, based on the DWG of 40.24g and the least feed cost/kg gain of ₦275.51 for broiler chickens in diet 5 compared to the others, it is recommended for broiler chickens.

## REFERENCES

- Adam, A. A. M. and El-Bashier, O. M. (2016). The effect of replacement of sorghum with millet on broiler performance. *International Journal of Science and Research*. 5. (4): 1966-1969.
- Adamu, S. B., Yaya, N. and Alade, N. K. (2000). *Comparative study of three energy sources on performance and carcass characteristics of broilers under a Sudano-Sahelian environment*. Proceeding of 6th Annual Conference of Animal Science Association of Nigeria 17th - 19th, September 2000. Akure-Nigeria pp 67-70.
- Adeola O., Rogler J. C. and Sullivan, T. W. (1994). Pearl millet in diets of white Pekin ducks. *Poultry Science*, 73: 425- 435.



- Afsharmanesh, M., Ghorbani, N. and Mehdipour, Z. (2016) Replacing corn with pearl millet (raw and sprouted with and without enzymes in Broiler chicken's diets. *Journal of Animal Nutritional*, **100**: 224-228.
- Ajala, A. O., Ogunjimi, S. I., Famuwagun, O. S. and Adebimpe, A. T (2021). Poultry production in Nigeria: Exploiting its potentials for rural youth empowerment and entrepreneurship. *Nigerian Journal of Animal Production*, **48**(1): 114 -123.
- Anyanwu, N. J., Obilonu, B. C., Odoemelam, V. U., Etela, I., Kalio, G. A. and Ekpe, I. I. (2020). Growth performance and haematological characteristics of finisher chickens fed palm kernel cake as partial replacement for maize soya bean. *Nigerian Journal of Animal Production*, **47**(4): 111 – 119.
- Bala, S., Sharma, R. K, Khan, N., Rastogi, A. and Haq, Z. (2017). Performance of broiler chickens as affected by replacement of maize with pearl millet and broken rice mixture in the diet. *Indian journal of Animal Nutrition*, **34**(4): 437-446.
- Baurhoo, N. B .B., Mustafa, A. F. and Zhao, X., (2011). Comparison of corn-based and Canadian pearl millet-based diets on performance, digestibility, villus morphology, and digestive microbial populations in broiler chickens. *Poultry Science*. **90**: 579-586.
- Cisse, R. S., Hamburg, J. D., Freeman, M. E. and Davis, A. J. (2017). Using locally produced millet as a feed ingredient for poultry production in Sub-Saharan Africa. *Journal of Applied Poultry Science Research*, **26**: 9-22.
- Duncan, D. B. (1955). Multiple Range and Multiple F. Test. *Biometrics*, **11**: 1-42.
- Gidado, A. S., Ogutoye, M. A. and Akintunde, A. R. (2020). Evaluation of maize-sorghum mixture based diets supplemented with exogenous enzyme on growth response, haematology and serum biochemical indices of starter broiler chickens. *Nigerian Journal of Animal Production*, **47**(4): 158 – 166.
- ICRISAT, (1984). *Agrometeorology of sorghum and millet in the Semi-arid tropics*. Proceedings of the International Symposium, 15 -20 November, 1992, ICRISAT, Patancheru, India.
- Kawu, Y. U. (2010). *Replacement value of gayamba millet variety for maize in broiler diets*. Unpublished Master's Thesis, Abubakar Tafawa Balewa University, Bauchi Nigeria.
- Kawu, Y. U., Muhammad, A, I., Husa, H., Doma, U. D., Abubakar, M. and Bello, K. M. (2020). Carcass yield and haematobiochemical indices of broiler chickens as affected by dietary replacement of yellow maize with *gayamba* pearl millet (*Pennisetum glaucum* L.) variety. *Nigerian Journal of Animal Production*, **47**(3): 253 – 261.
- Lawal, I., Bawa, G. S. Omege, J. J. and Afolayan, M. (2022). Effect of feeding soya bean residue supplemented with enzyme on haematology and serum biochemistry of Broiler finisher chickens. *Nigerian Journal of Animal Science and Technology*, **5**(2): 82 -91.
- Makkar, H. P. S. (2016). *Animal nutrition: Beyond the boundaries of feed and feeding* FAO, Rome, Italy. Retrieved 31<sup>st</sup> March 2021 from <https://www.feedipedia.org/content/animal-nutrition-beyond-boundaries-feed-and-feeding>
- Mohammed, A. B.(2025). *Nutritional evaluation of Egusi melon (Colocynthis citrullus L.) Seed cake in the diets of Broiler chickens*. Unpublished PhD Dissertation, Abubakar Tafawa Balewa University, Bauchi Nigeria. 153pp.
- Obasi, N. B. (2020). Effect of scent-leaf extract (*Ocimum gratissimum*) and neem leaf-extract (*Azadirachta indica*) fed as antimicrobial feed additive on finishing broilers. *Nigerian Journal of Animal Science*, **22**(1): 262 -269.
- Qaisrani, S. N., Murtaza, S., Khan, A. H., Bibi, F., Iqbal, S. M. J. Azam, F. *et al.* (2018). Variability in millet: Factors affecting its nutritional profile and zootechnical performance in poultry. *Journal of Applied Research*, **10**: 1-11.
- Sullivan T. W., Douglas, J. H., Andrews, D. J., Bowland, P. L., Hancock, J. D., Bramel-Cox, P. J., *et al.* (1990). *Nutritional value of pearl millet for food and feed*. Pages 83-94 in: Proc. Int. Conf. Sorghum Nutr. Qual. Purdue University, West Lafayette,
- Umar, M. (2018). Efficiency and Profitability of pearl millet production in the North – West region of Nigeria. A Ph.D. Thesis, Faculty of Agriculture, University Putra, Malaysia.



- World Atlas (2015): Where is Bauchi. Retrieved September 14, 2018 from <https://www.worldatlas.com/af/ng/ba/where-is-bauchi>.
- Yilkal, T., Tegene, N., Negassi, A. and Yadav, K.R. (2018). Effect of dietary replacement of maize with finger millet (*Eleusinecoracana*) grain on production performance and egg quality of white leghorn hens. *International Journal of Poultry Science*. **17**: 40-50.
- Yakubu, N., Doma, U. D., Kalla, D. J. U., Saidu, I. and Ahmed, I. A. (2020). *Utilization of dietary levels of super sosat millet (Pennisetum glaucum) by Broiler chickens*. Proceeding of 45th Annual Conference of Nigerian Society for Animal Production, pp 1412 -1418.
- Yunusa, Y., Doma, U. D., Zaharaddeen, D., Abubakar, S. B., Umar, A. and Isah, A. (2015). Performance and economics of broiler chickens fed different dietary energy sources. *Asian Journal of Poultry Science*, **9**: 41-49.