



**REPLACEMENT VALUE OF SUNFLOWER MEAL (*Helianthus annuus L.*) IN  
THE DIETS OF WEANER RABBITS**

**\*<sup>1</sup> Ojiri, I. S., <sup>2</sup>Abubakar. M., and <sup>2</sup>Egbo, M. L**

<sup>1</sup>Department of Animal Science, Faculty of Agriculture,  
Federal University, Kashere, Gombe, Gombe State, Nigeria

<sup>2</sup>Department of Animal Production, Faculty of Agriculture and Agricultural Technology,  
Abubakar Tafawa Balewa University, Bauchi, Bauchi State, Nigeria

**Corresponding Author's Email:** ojiri.i.suleiman@fukashere.edu.ng, **GSM:** 08069788920

**ABSTRACT**

The study investigated the replacement value of sunflower seed meal (SFM) for soyabean meal (SBM) in the diets of growing rabbits. A total of twenty (20) rabbits were allotted to five dietary treatments containing 0, 25, 50, 75, and 100% levels of SFM coded as diet 1,2,3,4 and 5 respectively. Each treatment had four (4) replicates with one rabbit per replicate. The experimental design was a completely randomized design and the study lasted for eight (8) weeks. Feeds and water were provided ad-libitum. The results indicated a non significant value for feed intake (74.84 -76.33 g). However, significant differences ( $P<0.05$ ) were observed in final body weight, total weight gain, daily weight gain, and feed conversion ratio (FCR). Rabbits on diet one (1) 0% SFM recorded the highest final body weight (1753.50 g) and daily weight gain (21.87 g), which did not differ from the values obtained on diets 2 and 3. Most of the carcass characteristics were not affected by the dietary treatments except carcass weight, forelimb and kidney weight at  $p< 0.05$ . Hematological parameters fell within the normal range for healthy rabbits. Similarly, serum biochemistry indices such as glucose, total protein, albumin, urea, and cholesterol were within normal ranges across all treatments. In conclusion, replacement of SBM with SFM at 75% supported optimal growth and carcass yield without adverse effects on hematological and serum indices. Hence, inclusion levels up to 75% SFM are recommended in rabbit diets to ensure optimal performance and health status.

**Keywords:** Sunflower, Meal, Soyabean, Meal, Growth, Performance,

**INTRODUCTION**

Rabbit production is increasingly recognized as a sustainable source of high-quality animal protein, owing to the species' rapid growth rate, efficient feed conversion, and lean carcass yield. These attributes make rabbits a viable option for addressing food security challenges in developing regions (Mafimidiwo *et al.*, 2024; Mohammed *et al.*, 2024). However, feed cost remains the most critical constraint to profitable rabbit production, with the rising prices of conventional protein sources such as soyabean meal driving the search for alternative ingredients. Sunflower (*Helianthus annuus L.*) and its by-products, including seed meal, oil, and leaf meal, have been identified as promising substitutes because of their favorable protein and energy profiles (Adetola *et al.*, 2019; Okedu *et al.*, 2022). Previous studies reported that sunflower oil supplementation enhanced rabbit growth without compromising carcass yield (Elsetiha *et al.*, 2019), while moderate inclusion of processed or dehulled sunflower seeds improved weight gain and feed utilization efficiency (Biobaku and Dosumu, 2021). Likewise, sunflower seed meal (SFM) has been shown to support satisfactory growth performance, nutrient digestibility, and carcass traits when properly incorporated into rabbit diets (Onazi *et al.*, 2020; Yusuf *et al.*, 2024). Despite these promising results, information on the effects of sunflower-based diets across varying inclusion levels, particularly regarding carcass characteristics, remains limited. This study therefore evaluates the growth performance and carcass traits of rabbits fed diets containing different levels of sunflower seed meal as a replacement for soyabean meal, with the aim of establishing safe and optimal inclusion levels for sustainable rabbit production.



## **MATERIALS AND METHODS**

### **Experimental Site**

The experiment was conducted at the Teaching and Research Farm, Abubakar Tafawa Balewa University, Bauchi, Nigeria. The area is located within the Southern Guinea Savannah on latitude 10° 18'37.2 N and longitude 9° 50'38.0 E, characterized by two well-defined seasons; Rainy season (May - October) and dry season (November - April). The average annual rainfall of Bauchi is about 1009 mm, 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).

### **Sources of Sunflower Seed Meal**

Sunflower seeds were procured from Muda Lawal Market, Bauchi, Bauchi State, and carefully cleaned to remove foreign materials. The seeds were roasted at 140–160 °C for 5–10 minutes with regular stirring to ensure uniform heating and reduce anti-nutritional factors. After cooling to room temperature, the seeds were finely ground using powered grinding machines and stored in airtight containers under cool, dry conditions to preserve quality. This processing enhanced nutrient availability and made the meal suitable for incorporation into rabbit diets.

### **Experimental Rabbits and their Management**

Twenty (20) growing Rabbits were randomly assigned to five (5) treatments of four (4) rabbits each in the study which lasted for eight (8) weeks. The animals were allowed a week adjustment period for acclimatization. The rabbits were housed in a well-constructed cage with provision of feeding trough and drinkers. Feed and water were provided *ad-libitum*.

They were given prophylactic treatment (preventive medication) before they were randomly allotted to the five treatments diets. Routine sanitary operations were also carried out from March – May, 2025. The rabbits were weight at the beginning of the experiment and weekly thereafter.

### **Experimental Diets**

Five (5) experimental diets (16 CP%) were formulated to contain graded level of sunflower seed meal to replace soyabean meal at 0, 25, 50, 75, and 100% and designated as diets 1, 2, 3, 4 and 5 respectively.

### **Ingredients and percentage composition of diets are shown in Table 1.**

**Table 1:** Ingredient and Calculated Nutrient Composition of Experimental Diets Containing Varying Levels of Sunflower Seed Meal as a Replacement for Soyabean Meal (SBM)

Ingredients	D1 (0%)	D2 (25%)	D3 (50%)	D4 (75%)	D5 (100%)
Maize	29.00	29.00	29.00	29.00	29.00
Soyabean meal	18.00	13.50	9.00	4.50	0.00
Sunflower meal	0.00	4.50	9.00	13.50	18.00
Wheat offal	30.00	30.00	30.00	30.00	30.00
Sweet potato peel meal	10.00	10.00	10.00	10.00	10.00
Groundnut haulm	10.00	10.00	10.00	10.00	10.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	16.00	16.00	16.00	16.00	16.00
Crude fibre (%)	12.30	12.46	12.27	12.25	12.15
ME kcal/kg	2469.40	2429.65	2409.90	2380.15	2328.40
Source: Ponzenga (1985)					



### **Data Collection**

The following data were collected on

### **Growth performance indices**

#### **Daily Feed Intake (g)**

Feed were served in the morning and evening using a weighing balance scale.

Daily Feed intake: The total quantity of feed given per day minus the leftover and then divided by the number of rabbits per pen as shown below.

$$\text{Daily feed intake} = \frac{\text{feed given} - \text{Leftover}}{\text{Number of rabbits per pen}} \quad \dots (1)$$

#### **Daily Weight Gain (g)**

This is the weight obtained multiply by 1000g and divided by the number of rabbits per pen x days (7) as shown below.

$$\text{Daily weight gain} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Number of rabbits per pen} \times \text{Days}} \quad \dots (2)$$

#### **Feed Conversion Ratio**

Feed conversion ratio was obtained mathematically.

$$\text{Feed Conversion Ratio} = \frac{\text{Quantity of feed consumed}}{\text{Weight gain}} \quad \dots (3)$$

#### **Carcass evaluation**

At the end of the eight (8) weeks, three (3) Rabbits from each treatment were randomly selected individually weighed, slaughtered, skinned and eviscerated. Weight of carcass and organs were also measured. Dressing percentage (DP) was obtained by weighing the carcass relative to the live weight of each rabbits and expressed in percentage (%) as shown below.

$$\text{DP} = \frac{\text{Carcass weight (g)}}{\text{Live Weight (g)}} \times 100 \% \quad \dots (4)$$

The rabbits were starved overnight before slaughtered. Starving helps to improve accuracy of estimation of real live weight and to reduce the volume of the gut contents and thereby reduce contamination of the carcass during dressing. Each rabbit was slaughtered by cutting the jugular vein with a sharp knife and eviscerated and weighed. The visceral organs were also removed carefully and weighed. The weights of the individual organ was weighed and expressed as percentages of live weight.

### **Chemical Analysis**

The proximate composition of experimental diets was determined according to the methods of AOAC (1990). For each nutrient, the sample was analyzed thrice, and an average was recorded as the representative value.

### **Statistical Analysis**

Data collected were subjected to one way analysis of variance (ANOVA) using the general linear model of statistical package for social science (SPSS) version 2007. The means were compared using Turkey test at 5% level of significance ( $P < 0.05$ ).

## **RESULTS AND DISCUSSION**

### **Growth Performance of Rabbits Fed Varying Levels of Sunflower Seed Meal (SFM) as a Replacement for Soybean Meal (SBM)**

The absence of significant differences ( $P > 0.05$ ) in initial body weight across treatments indicates that the experimental groups were balanced at the start, providing a reliable basis for comparison. However, significant variations ( $P < 0.05$ ) were observed in final body weight, total weight gain (TWG), and daily weight gain (DWG). Rabbits in the control group (0% SFM) attained the highest final weight (1,753.50 g), while those on 100% SFM recorded the lowest (1,485.25 g). Similarly, TWG and DWG declined progressively with increasing SFM inclusion, with the sharpest reduction occurring at full replacement. This pattern suggests that high levels of SFM impaired nutrient utilization, whereas up to 75% replacement maintained growth comparable to the control. Feed intake, both total and daily, showed no significant variation ( $P > 0.05$ ), implying that rabbits readily consumed diets containing SFM regardless of the inclusion level. However, the feed conversion ratio (FCR) varied significantly ( $P < 0.05$ ), increasing to 4.51 at 100% SFM compared

with 3.48–3.78 in other groups. This indicates that poorer efficiency at full replacement was due not to feed rejection but to reduce nutrient digestibility or imbalanced amino acid supply. These findings are consistent with earlier studies. Ajayi *et al.* (2007) and Adetola *et al.* (2019) reported that partial substitution with sunflower leaf meal or toasted sunflower diets sustained growth without adverse effects. Duwa *et al.* (2014, 2015) observed that rabbits tolerated 20–30% roasted SFM, but performance declined significantly beyond this level. Biobaku and Dosumu (2021) and Yusuf *et al.* (2024) further noted that moderate inclusion improved growth and digestibility, whereas excessive inclusion compromised performance. The sharp decline at 100% SFM in the present study reinforces the view that its higher fibre content and lower levels of essential amino acids, particularly lysine and methionine, limit growth when used as the sole protein source (Elbaz *et al.*, 2023). Overall, the significant differences observed in growth parameters and FCR underscore that while SFM can replace SBM up to 75% without compromising.

**Table 2:** Growth Performance of Rabbits Fed Varying Levels of Sunflower Seed Meal (SFM) as a Replacement for Soybean Meal (SBM)

Parameters	Treatments					SEM
	1 (0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)	
Initial weight (g)	528.75	543.25	542.25	543.00	540	3.86 <sup>ns</sup>
Final weight (g)	1753.50 <sup>a</sup>	1706.50 <sup>ab</sup>	1688.75 <sup>ab</sup>	1660.25 <sup>b</sup>	1485.25 <sup>c</sup>	22.55*
Total weight gain (g)	1224.75 <sup>a</sup>	1163.25 <sup>a</sup>	1146.05 <sup>a</sup>	1117.25 <sup>a</sup>	945.25 <sup>b</sup>	23.88*
Daily weight gain (g)	21.87 <sup>a</sup>	20.77 <sup>a</sup>	20.47 <sup>a</sup>	19.95 <sup>a</sup>	16.88 <sup>b</sup>	0.42*
Total feed intake (g)	4252.90	4191.06	4274.50	4224.50	4253.63	15.23 <sup>ns</sup>
Daily feed intake (g)	75.94	74.84	76.33	75.43	75.96	0.27 <sup>ns</sup>
FCR	3.48 <sup>b</sup>	3.61	3.73 <sup>a</sup>	3.78 <sup>a</sup>	4.51 <sup>b</sup>	0.09*

<sup>a,b,c</sup> on the same row shows significant difference ( $P < 0.05$ ), **SEM:** Standard error of the means **NS:** not significant; **FCR:** Feed conversion ratio.

### **Carcass Characteristics and Internal Organs Weights of Rabbits Fed Varying Levels of Sunflower Seed Meal (SFM) as a Replacement for Soybean Meal (SBM)**

The carcass characteristics of rabbits fed varying levels of sunflower seed meal (SFM) as a replacement for soyabean meal (SBM) revealed significant effects ( $P < 0.05$ ) at higher inclusion levels. Live weight, slaughter weight, carcass weight, and dressing percentage declined progressively with increasing SFM, with the most pronounced reduction ( $P < 0.05$ ) observed at 100% replacement. This reduction mirrors the growth performance results, suggesting that the high fibre content and less favorable amino acid profile of SFM limit nutrient utilization and muscle accretion (Belabbas *et al.*, 2019; Volek *et al.*, 2018). Non-edible components such as head, pelt, and hind limb proportions showed no significant variation ( $P > 0.05$ ) across treatments, indicating that external body structures were not markedly influenced by dietary SFM. However, forelimb and tail proportions increased slightly but significantly ( $P < 0.05$ ) at 100% SFM, likely reflecting reduced muscle deposition in the carcass. Internal organ weights, including the liver, lungs, caecum, and stomach, did not differ significantly ( $P > 0.05$ ), suggesting that moderate inclusion of SFM did not cause hypertrophy or atrophy of vital organs. In contrast, kidney proportion increased significantly ( $P < 0.05$ ) at higher SFM levels, possibly due to the greater metabolic demand for nitrogen excretion under conditions of less efficient protein utilization (Duwa *et al.*, 2014). Overall, the significant differences observed confirm that SFM can replace SBM up to 75% without compromising carcass yield and organ development. However, complete substitution (100%) significantly ( $P < 0.05$ ) reduced dressing percentage and carcass weight, thereby lowering meat quality and yield. These findings are consistent with previous studies, which reported that moderate inclusion of sunflower by-products sustains acceptable carcass traits (Ajayi *et al.*, 2007; Onazi *et al.*, 2020; Yusuf *et al.*, 2024).



**Table 3:** Carcass Characteristics and Internal Organs Weights of Rabbits Fed Varying Levels Sunflower Seed Meal (SFM) as a Replacement for Soybean Meal (SBM)

Parameters	Treatments					SEM
	1(0%)	2 (25%)	3 (50%)	4 (75%)	5 (100%)	
LW (g)	1260.37 <sup>a</sup>	1253.71 <sup>ab</sup>	1223.15 <sup>ab</sup>	1228.64 <sup>ab</sup>	1201.33 <sup>b</sup>	6.44 <sup>NS</sup>
Carcass Weight (g)	690.37 <sup>a</sup>	658.82 <sup>b</sup>	620.20 <sup>c</sup>	652.40 <sup>c</sup>	625.53 <sup>d</sup>	5.80 <sup>*</sup>
Dressed %	54.80 <sup>a</sup>	52.55 <sup>c</sup>	50.70 <sup>c</sup>	53.10 <sup>b</sup>	52.07 <sup>d</sup>	1.37 <sup>NS</sup>
Head (%)	9.52	9.65	9.70	9.96	10.19	0.15 <sup>NS</sup>
Pelt (%)	8.21	7.77	8.89	7.52	7.69	0.30 <sup>NS</sup>
Forelimb (%)	0.79 <sup>b</sup>	0.79 <sup>b</sup>	0.81 <sup>ab</sup>	0.81 <sup>ab</sup>	0.83 <sup>a</sup>	0.01 <sup>*</sup>
Hindlimb (%)	1.09	1.49	1.32	1.11	1.15	0.6 <sup>NS</sup>
Tail (%)	0.39 <sup>b</sup>	0.40 <sup>ab</sup>	0.41 <sup>a</sup>	0.40 <sup>ab</sup>	0.41 <sup>a</sup>	0.01 <sup>*</sup>
Lungs (%)	0.59	0.70	0.71	0.71	0.73	0.04 <sup>NS</sup>
Liver (%)	2.67	2.99	2.76	3.05	3.12	0.07 <sup>NS</sup>
Kidney (%)	0.79 <sup>a</sup>	0.79 <sup>a</sup>	0.81 <sup>ab</sup>	0.81 <sup>ab</sup>	0.83	0.01 <sup>*</sup>
Caecum (%)	6.83	7.69	7.66	7.31	7.48	0.26 <sup>NS</sup>
Stomach (%)	6.62	6.60	7.56	6.40	6.54	0.28 <sup>NS</sup>
Small intestine (%)	4.10	4.41	4.32	4.08	4.19	0.17 <sup>NS</sup>
Large intestine (%)	2.57	3.09	3.68	3.66	3.74	0.16 <sup>NS</sup>
Fat (%)	0.54	0.58	0.50	0.53	0.54	0.01 <sup>NS</sup>
Heart (%)	0.42	0.44	0.43	0.41	0.42	0.01 <sup>NS</sup>
Spleen (%)	0.07	0.06	0.06	0.07	0.07	0.01 <sup>NS</sup>

<sup>a,b,c,d,e</sup> on the same row shows significant difference ( $P < 0.05$ ), **SEM:** Standard error of the means **NS:** not significant, LW: live weight

## CONCLUSION AND RECOMMENDATION

The present study demonstrated that sunflower seed meal (SFM) can partially replace soyabean meal (SBM) in rabbit diets without compromising growth performance or carcass yield. Replacement of soyabean meal with sunflower seed meal at (up to 75%) however gave the best performance. These reductions are attributable to the higher fibre content and less favorable amino acid profile of SFM, which limit nutrient utilization at high inclusion levels.

Based on these findings, it is recommended that SFM be included in rabbit diets at levels not exceeding 75 % substitution for SBM. Beyond this threshold, growth and carcass quality are adversely affected, making full replacement unsuitable. To improve the potential of SFM as a feed resource, further research should focus on nutrient supplementation strategies such as amino acid fortification, enzyme application, or processing methods that could enhance digestibility and broaden its safe inclusion range in rabbit nutrition.

## REFERENCES

- Adetola, O. O., Adewumi, M. O., Oyedare, K. S., Adetayo, T. O. and Ayoola, A. M. A. (2019). Growth response, nutrient digestibility and carcass analysis of weaned rabbits fed graded levels of toasted sunflower (*Helianthus annuus*) based diets. *Nigerian Journal of Animal Science*, **21**(3): 325–333.
- Ajayi, A. F., Farinu, G. O., Ojebiyi, O. O., and Olayeni, T. B. (2007). Performance evaluation of male weaner rabbits fed diets containing graded levels of blood-wild sunflower leaf meal mixture. *World Journal of Agricultural Sciences*, **3**(2): 250–255.
- Aliyu, A. M., Bawa, G. S., Afolayan, M., Ishiaku, Y. M., and Bishir, B. B. (2024). Haematological parameters of rabbits fed graded levels of sunflower seed (*Helianthus annuus* L.) cake. *Nigerian Journal of Animal Production*, **5**: 497–500. <https://doi.org/10.51791/njap.vi.5035>
- Amao, E. A., Sokunbi, A. O., and Tijani, H. T. (2024). Blood chemistry and haematological indices of rabbits fed supplementary wild sunflower (*Tithonia diversifolia* Helms. A.Gray) leaf meal. *Nigerian Journal of Animal Production*, **5**: 268–271. <https://doi.org/10.51791/njap.vi.4595>



- Biobaku, W. O., and Dosumu, E. O. (2021). Growth response of rabbits fed graded levels of processed and dehulled sunflower seeds. *Nigerian Journal of Animal Production*, **30**(2): 179–184. <https://doi.org/10.51791/njap.v30i2.1473>
- Duwa, H., Girgiri, A. Y., Maina, M. M., Igwebuike, J. U., and Saleh, B. (2015). Haematology and blood chemistry of weaner rabbits fed graded levels of roasted sunflower (*Helianthus annuus* L.) seed meal in the semi-arid zone of Nigeria. *International Journal of Innovative Agriculture and Biology Research*, **3**(2): 10–16.
- Elsetiha, W., El-Hais, A., Younan, G., and El-Rayes, T. (2019). Productive performance of rabbits fed on diets supplemented with sunflower oil. *Egyptian Journal of Nutrition and Feeds*, **22**(1): 179–189. <https://doi.org/10.21608/ejnf.2019.76348>
- Fakolade, P. O., and Adetomiwa, A. A. (2018). Performance and carcass characteristics of weaner rabbits fed wild sunflower (*Tithonia diversifolia*) inclusion in their diet. *International Journal of Development and Sustainability*, **3**(8): 2216–2226.
- Mafimidiwo, A. N., Nwachukwu, I. E., Adedapo, E. T., and Adeyanju, S. F. (2024). Growth performance and carcass characteristics of growing rabbits fed diets containing maggot meal as a replacement for soyabean meal. *Nigerian Journal of Animal Production*, **5**: 81–84. <https://doi.org/10.51791/njap.vi.4308>
- Mohammed, J. D., Adama, T. Z., and Tsado, D. N. (2024). Growth performance, nutrient digestibility and carcass characteristics of rabbits fed varying levels of groundnut haulm with concentrate. *Nigerian Journal of Animal Production*, **5**: 1274–1278. <https://doi.org/10.51791/njap.vi.5565>
- Okedu, F., Ahaotu, E. O., de los Ríos-Escalante, P., and Nwabuisi, D. (2022). Evaluation of Mexican sunflower (*Helianthus annuus* L.) leaf meal as a feed ingredient in Shaver Brown pullets. *Brazilian Journal of Biology*, **84**: 243–248. <https://doi.org/10.1590/1519-6984.243238>
- Onazi, B. O., Alu, S. E., Ogah, D. M., Adua, M. M., and Baba, M. K. (2020). Effect of Ronoxyme Hiphos® supplementation on nutrient digestibility and blood parameters of grower rabbits fed sunflower seed meal-based diets. *Nigerian Journal of Animal Production*, **47**(6): 54–64.
- Volek, Z., Ebeid, T., and Uhlířová, L. (2018). The impact of substituting soyabean meal and sunflower meal with a mixture of white lupine seeds and rapeseed meal on rabbit doe milk yield and composition, and the growth performance and carcass traits of their litters. *Animal Feed Science and Technology*, **236**: 187–195. <https://doi.org/10.1016/j.anifeedsci.2017.12.011>
- World atlas. (2015) Climate of Bauchi, Nigeria. Retrieved from <https://www.worldatlas.com>
- Yusuf, A. A., Nyako, N. D., and Yahya, M. M. (2024). Effects of graded levels of fermented sunflower seed meal on growth performance and nutrient digestibility of growing rabbits. *Nigerian Journal of Agriculture and Agricultural Technology*, **4**(4A): 274–282. <https://doi.org/10.5897/njaat2024.0444>