



## EFFECTS OF GRADED LEVELS OF FERMENTED SUNFLOWER SEED MEAL ON GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF GROWING RABBITS

<sup>1</sup>Yusuf, A. A., <sup>2</sup>Nyako, N. D. and <sup>2</sup>Yahya, M.M.

<sup>1</sup>Department of Agric. Education Federal College of Education (Tech.) Gombe, Gombe State.

<sup>2</sup>Department of Animal Science and Range Management, Modibbo Adama University Yola

**Corresponding Author's Email:** alhajiyusufabba@gmail.com. **GSM:** 08063625834

### ABSTRACT

An eight weeks feeding trial was conducted on the effects of graded level of fermented sunflower seed meal on the performance and nutrient digestibility of growing rabbits using forty-five Rabbits cross bred (New Zealand X Dutch) ranging from five to six weeks of age with average weight of 650.34 g. The rabbits were randomly allotted to five dietary treatments of nine rabbits each replicated 3 times with 3 rabbits per replicate in a Completely Randomized Design, each treatment diet contains 0, 5, 10, 15 and 20% FSSM in diet 1(control), 2,3,4 and 5 respectively. The parameters measured include proximate composition of fermented sunflower seed meal, feed intake, weight gain and feed conversion ratio. Others are nutrient digestibility such as dry mater (DM), Crude protein (CP), Crude Fiber (CF), Ether Extract(EF), Ash and Nitrogen Free Extract (NFE). The results for Growth Performance Parameters indicated that There were significant ( $P<0.05$ ) differences among the treatment groups in total body weight and daily feed intake which ranges between 553.95 to 614.70 g and 45.02 to 52.16g respectively. However, the results for nutrient digestibility showed significant ( $P<0.05$ ) difference among treatment groups for crude protein, crude fiber, ether extract, ash and nitrogen free extract. Conclusively, inclusion of 20% FSSM in Rabbits diet gave a better result on growth performance and nutrient digestibility without any adverse effect and can be adopted by Rabbit farmers for better performance.

**Key words.** Rabbit, sunflower, performance, nutrients, digestibility

### INTRODUCTION

The rapid increase in human population had resulted to large increase in the demand for animal protein which is essentially higher in quality than that of plant protein. The average protein intake in Nigeria is about 5.5g of animal protein per day which is low and far below Food and Agriculture Organization of United Nations (FAO) recommendation of 77g of animal protein per day (FAO 2006). The nutritional requirement of man is crucial particularly in a developing country such as Nigeria where malnutrition and starvation are the major challenge faced by millions of rural dwellers. The low protein intake is an indication of shortage of high quality protein food in the diet of Nigerians per day. Rabbit is a good source of meat which is of high quality with low cholesterol and therefore suitable for special diets. The prolific nature of rabbits coupled with it short gestation period makes it the animal of choice for multiplication and a short way of increasing animal protein intake (Akinmutimi 2006). Rabbit also have the advantage of being able to consume fibrous feedstuffs that are not utilized by human because of the presence of their large caecum (Gulunkun *et al* 2023). Meat from rabbit of any age has reported to be highly appreciated for human consumption and a source of healthy food as it is good for coronary heart patients (Nodu *et al* 2003). High feed cost is one of the major challenges of animal production in developing countries such as Nigeria, where many of the conventional livestock feed ingredients like maize and soya bean



also serve as food to human (Yusuf *et al* 2023). Gulunkun *et al* (2023) reported that the rapid growth of human and livestock population is creating an increase in the need for food and feed in developing countries. Therefore, an urgent need to search an alternative source to these conventional livestock feed, so that the production and consumption of animal products may continue in the desirable path of rapid growth. One of such alternative that is not only cheap but locally available and has potentials but is yet to be exploited in animal nutrition is sunflower seed meal in other to substitute for the scarce and expensive feed resources (Duwa *et al* 2014). The study was there for design to determine the effect of feeding graded levels of fermented sunflower seed meal on growth performance and nutrient digestibility of growing rabbits.

## **MATERIALS AND METHODS**

### **Experimental Site**

The experiment was carried out at the Department of Animal Science, Livestock Teaching and Research Farm of the Federal College of Education (Technical) Gombe. The Gombe state is located between Latitude 10° 15' 00" N, 10° 19' 30" N and Longitude 11° 07' 15" E, 1° 13' 30" E., at an altitude of 352 m above sea level and has a land area of 52km<sup>2</sup> (Stephen *et al.*, 2023). The area has a semi-arid tropical climate with a wide seasonal range of temperature. The hottest months are March and April with a range between 18 and 40°C. There is long dry season of 6 to 7 months between the month of October to April. The first three months of dry season are characterised by the harmattan while the last 2 to 3 months of the dry season there is hot diurnal temperature and comparatively cooler night this is followed a wet season between the months of May and October. The average annual rainfall is about 850 mm. The relative humidity ranges from 30 to 45% in August and usually lower to about 5% in December and January (Saleh *et al.*, 2018)

### **Experimental Animal and their Management**

A total of forty-five weaner rabbits of mixed breed (Dutch x and New Zealand white), sexes and age ranging from 4 to 6 weeks were purchased from rabbit keepers in Gombe Metropolis and were used for the experiment. They were randomly allocated to five treatment groups of nine rabbits each. The rabbits were housed individually in cages measuring 35 cm x 36 cm x 45 cm (width x length x height). The experimental diets (in mash form) and clean drinking water were provided ad libitum throughout the experimental period.

### **Experimental Diet**

The experimental diets were compounded using the following ingredients: maize soya bean, wheat offal, sunflower seed meal, bone meal and salt were used to formulate five experimental diet. Such that diet 1 (T<sub>1</sub>) contained 0% of sunflower seed meal which served as control. Fermented Sun flower seed meal was included at 5, 10, 15 and 20% inclusion levels diet of 2, 3,4 and 5 respectively as shown in Table 1

**Table 1: Composition and Calculated Analyses of the Experimental Diets (%)**

Ingredients	Treatments				
	T <sub>1</sub> (0%)	T <sub>2</sub> (5%)	T <sub>3</sub> (10%)	T <sub>4</sub> (15%)	T <sub>5</sub> (20%)
Maize	40.00	36.00	33.00	30.00	28.00
Soya bean	23.00	22.00	20.00	18.00	15.00
Fermented sunflower seed meal	0.00	5.00	10.00	15.00	20.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Groundnut haulms	15.95	15.95	15.95	15.95	15.95
Wheat offal	15.00	15.00	15.00	15.00	15.00
Salt (NaCl)	0.30	0.30	0.30	0.30	0.30
Bone meal	2.50	2.50	2.50	2.50	2.50
Premix	0.25	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>Calculated analyses</b>					
Crude protein (%)	17.49	18.52	18.86	18.85	18.71
Crude fibre (%)	9.24	9.73	11.14	12.56	12.96
Ash (%)	4.86	4.82	4.83	4.84	4.81
ME (Kcal/kg)	2706.35	2682.00	2519.98	2432.70	2358.70

*Premix (grow fast) manufactured by Animal Care Service Consult (NIG) Ltd, Lagos supplied the following per kg of premix: Vitamin A, 500.00 IU; Vitamin D<sub>3</sub> 800.00 IU; Vitamin E, 12,000 mg; Vitamin K 1,500 mg; Vitamin B<sub>1</sub>, 1,000 mg; Vitamin B<sub>2</sub>, 2,000 mg; Vitamin B<sub>6</sub>, 1,500 mg; Niacin, 12,000 mg; Pantothenic acid, 20.00 mg; Biotin, 10.00 mg; Vitamin B<sub>12</sub>, 300 mg; Folic acid, 150,000 mg; Choline, 60,000 mg*

## Experimental Design and Duration

The five experimental treatments (diets) were assigned to the five groups in a Complete Randomized Design (CRD). Each treatment was replicated three times and there were three rabbits per replicate. The study lasted for 8 weeks.

## Data Collection

### Feed intake

Feed consumption from each treatment was measured on daily basis by subtracting the left over from the feed served per group. Adequate measures were taken to avoid spillage and waste. The mean daily feed intake was calculated by dividing the quantity feed consumed by the number of the rabbits in the same group.

Feed intake = feed supplied – left over

### Body weight

Rabbits were weighed individually (weekly) using a weighing balance to determine their weight. The mean live weight of each treatment group was determined by dividing the total weight by the total number of rabbits in that group.

$$\text{Body Weight} = \frac{\text{Mean Live Weight of the Rabbits}}{\text{Total Number of Rabbits in the Group}}$$

### Body weight gain

The body weight gain of each of the treatment group was obtained by calculating the difference between the mean live weight of the current week and the mean live weight of the previous week divided by seven days in a week to obtain daily weight gain.

Weight gain = final weight – initial weight



### **Feed conversion ratio (FCR)**

This was obtained on a weekly basis. It was measured by dividing the mean feed intake per rabbit in grammas by the mean live weight gain per rabbit for each treatment group as shown below:

$$\text{FCR} = \frac{\text{Mean feed intake}}{\text{Mean body weight gain}}$$

### **Digestibility Trial**

Seven (7) days to the termination of the feeding trial, three rabbits per treatment were moved to a metabolic cage, acclimatizes for three days before collection of the faecal sample and rabbits were fed known amount of feed. Faecal sample were collected, oven dried and weight. After that, faecal and the feed sample were analysed for proximate composition according to the standard procedure of (AOAC 2005). Nutrients weight in the diet and faeces were calculated using the weight of diet consume and faecal sample collected and their determined composition from which apparent digestibility coefficient were calculated as stated by (Aduku 2004)

### **Statistical Analysis**

All data collected were stored and managed using Microsoft Excel (2016). Data were subjected to one-way analysis of variance (ANOVA) in a Completely Randomized Design (CRD) using statistix 9.0 software (Statistix 2013). Significant differences among the treatment means were separated using Least Significant differences (LSD)

## **RESULTS AND DISCUSSION**

### **Proximate Composition of Experimental Diet and Sunflower Seed Meal.**

The proximate composition of the experimental diet and sunflower seed were presented in Table 2. The results showed that sunflower seed contained 93.55% dry matter (DM), 22.10% crude protein (CP), 5.44% crude fiber (CF), 6.80% Ash, 30.73% nitrogen free extract (NFE) and 3040 Kcal/kg. These values were lower than the values (DM) 94.26%, (CP) 27.60%, (CF) 15.29% EE 8.50% (NFE) 39,% and ME 3104.20 Kcal/kg reported by Adetola *et al.*, (2019) who fed rabbits with toasted sunflower seed meal. However, the values obtained in this study were similar to the values (DM) 91.22%, (CP) 23.50%, (CF) 44.00% Ash 4.70% and (NFE) 44.10% opined by Duwa *et al* (2015) who fed weaner rabbits with roasted sunflower seed meal. The variation between this results and that of Adetola *et al* (2019) could be due to soil type and stages of the harvest, the results of the study also showed that sunflower seed contained the necessary ingredient that can support the performance of growing rabbits

The experimental diet had dry matter ranges from 91.56 to (93.11%) crude protein (20.32 to 23.41%) crude fiber (14.60 to 17.34%) ether extract (7.09 to 8.24%) nitrogen free extract (40.05 to 50.28%) Ash (5.62 to 7.68%) and ME (kcal/kg) 2841 to 3194 (kcal/kg.) the dry matter and crude protein composition were close to the values 96.64 to 98.43% and 18.70 to 20.07 respectively obtained by Oseiko *et al.*, (2020) who reported raw and roaster sunflower seed meal. However, the DM and CP values were also lower than 90.00 to 91.00 and 19.11 to 20.21 as opined by Onazi *et al.*, (2020) who fed sunflower seed meal based- diet to growing rabbits. The crude fiber values obtained in the study is lower than 4.34 to 5.00 as revealed by Adetola *et al.*, (2019) who fed rabbits with toasted sunflower seed meal. However, the values were also higher than 8.73 to 10.34 reported by Duwa *et al.*, (2014) who revealed that raw and roasted sunflower seed meal and this variation could be as a result of difference in soil and variety of seed. Ether extract values were similar to 7.00 to 8.11 as revealed by Sani (2020) after feeding rabbits with three different energy source to growing





**Table 2. Proximate Composition of Experimental Diet and Sunflower Seed Meal.**

Nutrients(%)	Treatments					SSM
	T <sub>1</sub> (0%)	T <sub>2</sub> (5%)	T <sub>3</sub> (10%)	T <sub>4</sub> (15%)	T <sub>5</sub> (20%)	
Dry matter(DM)	93.11	91.56	92.34	93.04	91.62	93.55
Crude protein	20.32	23.41	22.52	21.32	23.26	22.00
Crude fibre(%)	17.34	15.61	14.68	15.36	15.21	5.44
Ether extract(%)	8.24	7.19	7.12	7.20	7.09	6.80
Nitrogen free extract(%)	40.05	49.89	50.28	45.61	48.64	30.73
Ash	5.62	7.68	6.76	7.46	6.96	6.80
ME (kcal/kg)	2841.10	3172.00	3194.20	2992.10	3161.01	3040.00

FSSM = Fermented sunflower seed meal, SSM = Sunflower seed, SEM= Standard error of mean.

### **Growth Performance of Growing Rabbits Fed Grade Level of Fermented Sunflower Seed Meal.**

There were significant ( $P < 0.05$ ) differences among the treatment groups in total body weight and daily feed intake which ranges between 553.95 to 614.70 g and 45.02 to 52.16g respectively. The values for the daily feed intake reported here were lower than the values (53.08 to 63.60g) recorded by Yusuf *et al.*, (2023) who fed soaked and fermented pumpkin seed meal to growing rabbits. However, the values were also lower than (58.0 to 62.0 g) recorded by Igweebuikwe *et al.*, (2005) who fed various level of *Acacia albida* pot to a growing rabbits The differences observed in the feed intake could probably be as a result of the physical forms of the diet, age and temperature of the study area. However, there were no significant ( $P > 0.05$ ) difference among the treatment groups for initial body weight, final body weight, daily weight gain, total feed intake, feed conversion ratio and feed efficiency ratio. The values for the final body weight reported here were lower than the values (1517.20 to 1871.70g) revealed by Adetola *et al* (2019) who fed rabbits with graded levels of sunflower hull meal. However, the values were within the range of 830.0 to 1104.2g reported by Yahya *et al* (2020) who fed rabbits with different levels of African locust bean (*Parkia bilglobosa*), the values of the initial weight, final weight, feed intake and daily weight gain were also lower than 850.00 to 883.00 g, 1578.33 to 1715.00g, 62.10 to 72.13g, and 13.01 to 15.09g respectively as reported by Mafimidiwo *et al.*, (2020) who fed fermented cassava root – leaf blend meal to growing rabbits and lower than 420.45 to 496.25, 835.3 to 984.7 and 2783.34 to 2954.51 g for initial weight, final weight and total feed intake respectively reported by Adamu *et al* (2023) who fed rabbits with hydroponic maize fodder.

The feed conversion ratio (FCR) of 4.31 to 4.89 obtained in the study were below the range values of 5.16 to 6.02 obtained by Yunus (2015) who fed rabbits with boiled - fermented sorrel seed meal but were within the ranged of 4.33 to 5.10 as opined by Mafimidiwo *et al.*, (2020). However, the values were within the range of 4.90 to 5.43 reported by Yusuf *et al.*, (2023). And fall within the values of 3.90 to 6.01g reported by Hajjati *et al.*, (2011) who fed pumpkin seed meal to growing rabbits. These differences could be attributed to the different processing methods of the sunflower seed meal. The feed efficiency ratio obtained in this study 0.21 to 0.23 were higher than the recommended range of 0.10 to 1.46 reported by Patience *et al.*, (2018) who fed rabbits with wild sunflower seed. This was supported by Banerjee (2005) who opined that feed efficiency ratio could be used in evaluating the quality of feed in the diet of growing rabbits. Therefore, the performance of the rabbits in this research showed that fermented sunflower seed meal (FSSM) contained the



essential nutrients that can support adequate growth of rabbits in various levels of the inclusion

**Table 3: Growth Performance of Rabbits Fed Graded Levels of Fermented Sunflower Seed Meal (FSSM).**

Treatments						
Parameters	T <sub>1</sub> (0%)	T <sub>2</sub> (5%)	T <sub>3</sub> (10%)	T <sub>4</sub> (15%)	T <sub>5</sub> (20%)	SEM
Initial body weight (g)	500.24	510.35	515.55	524.26	520.36	75.01 <sup>NS</sup>
Final body weight (g)	1061.94	1088.76	1069.50	1138.96	1098.87	73.96 <sup>NS</sup>
Total weight gain	561.70 <sup>c</sup>	578.41 <sup>b</sup>	553.98 <sup>d</sup>	614.70 <sup>a</sup>	578.51 <sup>b</sup>	0.72 <sup>*</sup>
Daily weight gain (g)	10.03	10.32	9.89.	10.97	10.33.	1.16 <sup>NS</sup>
Total feed intake (g)	2524.80	2590.80	2550.21	2651.30	2580.61	0.75 <sup>NS</sup>
Daily feed intake (g)	45.08 <sup>d</sup>	46.26 <sup>b</sup>	45.53 <sup>c</sup>	47.34 <sup>a</sup>	46.08 <sup>ab</sup>	2.66 <sup>*</sup>
Feed conversion ratio (FCR)	4.49	4.48	4.60	4.58	4.46	0.33 <sup>NS</sup>
Feed efficiency ratio	0.21	0.22	0.22	0.21	0.20	0.01 <sup>NS</sup>

NS= not significance ( $P>0.05$ ), N= significant ( $p<0.005$ ), a.b= mean in the same row with different superscript differ significantly ( $p<0.05$ ), SEM= Standard error of mean.

### **Nutrient Digestibility of Growing Rabbits fed Graded Level of Fermented Sunflower Seed Meal**

There were significant ( $P<0.05$ ) difference among treatments groups for crude protein, crude fibre, ether-extract, ash and nitrogen free extract. The crude protein of T<sub>1</sub> (control) is significantly ( $P<0.05$ ) lower than the fermented sunflower seed meal based diet while the highest was recorded in T<sub>4</sub> (15% FSSM) and the values obtained for the crude protein in this study are below the values of 76.32 to 84.39 reported by Duwa *et al.*, (2014) who fed roasted sunflower seed meal to a growing rabbits and similar to the values 55.39 to 67.30% opined by Patience *et al.*, (2018) who fed wild sunflower seed meal to a growing rabbits.. The digestibility of crude fibre which ranges from 32.29 to 42.65% is similar to 42 and 44%. Reported by Yunus (2015) who fed rabbits with fermented and boiled sorrel seed meal. However, the values were lower than 63.01 to 69.21% reported by Igwebuike. *et al.*, (2005) who fed rabbits with sorrel seed meal. However, Doma *et al* (2009) reported that rabbits fed fibrous diets compensate for low nutrient density of such diet through voluntary feed intake. Ether-extract values obtained in the study ranged between 52.98 to 67.23% and the values fell within the ranged of 51.20 to 60.40% recorded by Adetola *et al.*, (2019) who fed pumpkin seeds meal to a growing rabbit. The Ash and nitrogen free extract values obtained were within the ranged of 61.5 to 67.23% and 49.57 to 65.67% respectively and the values of the nitrogen free extract obtained in this study were higher than the values 37.64 to 52.52 reported by Adedire *et al.*, (2012) who fed fermented crop residue with *Rhizopus oligozopus* to growing rabbits. However, the results of this study showed that there were no significant ( $P>0.05$ ) differences among the treatment groups for digestibility of dry matter which ranges from 56.62.01 with T<sub>5</sub> (20%FSSM) having the highest value while T<sub>1</sub> (control) having the lowest dry matter digestibility and these values were lower than the ranged values of 86.34 to 89.02% reported by Yusuf *et al* (2023) who fed soaked and boiled pumpkin seeds to growing rabbits. This values were similar to the values reported by Kwari *et. al.* (2010) who fed different levels of sorrel seed meal to growing rabbits, the increase in the values might be attributed to the processing method of the sunflower seed meal. The digestibility of nutrients observed in this study indicate that the nutrients in the fermented sunflower seed meal were well digested and capable of supporting the growth and productivity of growing



rabbits. The results were supported by Ani (2008) who suggested that fermented *Senna obtusifolia* enhance the reduction of digestive loss.

**Table 4; Nutrient Digestibility of Rabbits Fed Graded Levels of Fermented Sunflower Seed (FSSM)**

Treatments Parameters(%)	T <sub>1</sub> (0%)	T <sub>2</sub> (5%)	T <sub>3</sub> (10%)	T <sub>4</sub> (15%)	T <sub>5</sub> (20%)	SEM
Dry matter (DM)	56.62	61.32	60.81	61.58	62.01	2.11 <sup>NS</sup>
Crude protein (CP)	45.91 <sup>d</sup>	51.35 <sup>c</sup>	50.42 <sup>b</sup>	57.16 <sup>ab</sup>	52.77 <sup>ab</sup>	2.78*
Crude fibre (CF)	32.29 <sup>c</sup>	34.22 <sup>d</sup>	40.92 <sup>b</sup>	40.54 <sup>ab</sup>	42.65 <sup>a</sup>	0.99*
Ether extract (EE)	52.98 <sup>d</sup>	64.69 <sup>b</sup>	67.81 <sup>ab</sup>	67.82 <sup>a</sup>	63.66 <sup>c</sup>	1.77*
Ash	61.51 <sup>d</sup>	66.26 <sup>c</sup>	65.67 <sup>ab</sup>	67.23 <sup>a</sup>	66.96 <sup>b</sup>	1.75*
Nitrogen free extract (NFE)	49.57 <sup>d</sup>	60.82 <sup>ab</sup>	63.66 <sup>b</sup>	65.67 <sup>a</sup>	60.38 <sup>c</sup>	1.86*

FSSM = fermented sunflower seed meal.

A, b, c, d, o = means in the same row with different superscript differ significantly ( $p>0.05$ ).

N = significant

NS = not significant.

## CONCLUSION AND RECOMMENDATION

In conclusion however, inclusion of 20% FSSM IN Rabbit diet gave a better result on growth performance and nutrient digestibility without any adverse effect and can be adopted by rabbit farmers for better performance.

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