



## GROWTH PERFORMANCE AND ECONOMIC ANALYSIS OF GROWER RABBITS FED GRADED LEVELS OF TIGER NUT RESIDUE

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### ABSTRACT

This study evaluated the growth performance of grower rabbits fed diets containing graded levels of tiger nut residue (TNR). Thirty rabbits were randomly assigned to five dietary treatments in a Completely Randomized Design (CRD). The diets included 0% (control), 2%, 4%, 6%, and 8% levels of TNR. Data on feed intake, body weight gain, feed conversion ratio, and mortality were collected over an eight-week period and analyzed using ANOVA. Results revealed no significant differences ( $P>0.05$ ) in final body weight, daily weight gain, feed intake, or feed conversion ratio across treatments. Rabbits fed diets containing TNR performed comparably to those on the control diet, indicating that inclusion up to 8% does not adversely affect growth performance. Feed cost per kilogram showed a progressive reduction with increasing levels of tiger nut residue inclusion. T1 (control) had the highest feed cost at ₦173.56/kg, while 8% showed the lowest cost at ₦159.68/kg. 8% showed the most favorable result with ₦800.78/kg gain, representing the lowest cost per unit of weight gain. This was followed by T4 (₦870.13/kg gain) and T1 (₦854.45/kg gain). T3 and T2 showed higher costs per kilogram gain at ₦907.70 and ₦929.15 respectively. The results suggest that TNR, an agro-industrial byproduct often discarded as waste, can serve as an alternative energy source in rabbit nutrition. Its incorporation has the potential to reduce reliance on costly conventional feedstuffs and contribute to more sustainable livestock production.

**Keywords:** Rabbit, Tiger nut, Residue, Growth, Weight

### INTRODUCTION

In Nigeria, conventional feedstuffs especially energy sources like maize, wheat, millet and guinea corn are becoming increasingly costly and scarce. This has led to the search for alternative feedstuffs for use in animal production especially poultry species, which are the major sources of animal protein in Nigeria. Such alternative feed ingredients should of necessity be available all year round; easy to be procured and processed, if need be, into usable forms and must have a comparable cost advantage over the conventional feed stuffs (Oyebiyi *et al.*, 2017). Such feed stuffs must not be a staple item for human food (Okonkwo and Adikpe, 2019). At present in Nigeria, there are many agricultural and industrial byproducts that have found their usefulness in livestock feeding (Togun and Oseni, 2015). A species that can be exploited in this direction is *Cyperus esculentus* commonly called tiger nut. It possesses as much agronomic and nutritional potential as the conventionally used energy sources. Tiger nut is commonly known as earth almond, *chufa*, *chew-fa* and *Zulu* nuts in Spain. It is known in Nigeria as *Aya* in Hausa, *Ofio* in Yoruba, *Akihausa* in Igbo and *Isip-Isong* in Efik where these varieties (black, brown and yellow) are cultivated. Tiger nut can be eaten raw, roasted, dried, baked or can be made into a refreshing beverage called *Horchata De Chufas* or tiger nut milk. In Nigeria, the Tiger nut can be grown virtually everywhere. Residue after milk extraction is being discarded by the beverage industries as waste, even though it is said to have high energy content. The successful exploitation of this plant would add to the feed resources available to the livestock industry in Nigeria. the study was to determine the response of grower rabbit fed fermented graded level of tiger nut residue on performance of grower rabbits.



## MATERIALS AND METHODS

### Experimental Site

The study was conducted at the Rabbit Unit of the Taraba State University, Teaching and Research Farm, Jalingo local Government Area, Taraba State, Nigeria.

### Source and preparation of tiger nut residue

The tiger nut residue for this study was procured from tiger nut milk extraction beverage industries in Jalingo. It was air dried and further used in the formulation of the experimental diets.

### Experimental Diets

Five (5) experimental diets were formulated for this study that met the nutritional requirement of rabbits. Diet 1 (T1) served as the control diet containing 0% tiger nut residue meal while Diets 2 (T2), Diet 3 (T3), Diet 4(T4) and Diet 5(T5) containing 2, 4, 6 and 8% inclusion levels respectively as presented in Table 1.

**Table 1:** Percentage Ingredients Composition and Calculated Analysis of Grower Rabbits Diet

Tiger nut Residue	T1 (0%)	T2 (2%)	T3 (4%)	T4 (6%)	T5 (8%)
<b>Ingredients</b>					
Maize	35.00	35.00	35.00	35.00	35.00
FFS	28.60	28.60	28.60	28.60	28.60
Maize offal	20.00	18.00	16.00	14.00	12.00
Tiger nut residue	0.00	2.00	4.00	6.00	8.00
Rice offal	13.30	13.30	13.30	13.30	13.30
Bone meal	0.70	0.70	0.70	0.70	0.70
Limestone	0.70	0.70	0.70	0.70	0.70
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Premix	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
<b>Calculated analysis</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
ME (Kcal/kg)	2739.70	2689.70	2639.70	2589.70	2539.70
CP (%)	16.00	15.82	15.64	15.46	15.28
Fat (%)	7.51	7.45	7.08	7.34	7.28
CF (%)	9.81	9.57	9.33	9.09	8.85
Ca (%)	0.51	0.51	0.51	0.51	0.51
Avail. P (%)	0.34	0.34	0.34	0.33	0.33

TNR= Tiger nut Residue

### Design and Management of Experimental Animals

Thirty (30) rabbits were randomly assigned to five treatments of six rabbits per treatment and each replicated three times with two rabbits per replicate in a Completely Randomized Design experiment (CRD). The rabbits were allowed one weeks pre-conditioning period to acclimatize them and to dewormed before the commencement of the experiment. The experiment lasted for 8 weeks. They were be given prophylactic coccidiostat (Amprovitracycline) via drinking water. Daily washing of feeders and drinkers, and disinfecting of the pens were carried out. The rabbits were fed twice a day (morning and evening). Clean water and experimental diet were provided ad-libitum, plastic bowls were used as feeders and drinkers.

### Data Collection

The following data were collected for the experiment:

#### Performance parameters

##### Feed Intake

A known weight of feed for each replicate was given and recorded daily. The left over after each day's meal, was kept separately, measured and recorded for each replicate on a daily basis. Feed



consumption for each day was obtained from the differences between the feed given per day and the left over.

$$\text{Total feed intake (kg)} = \text{total feed given (kg)} - \text{total feed left over (kg)}$$

$$\text{Average daily feed intake (g)} = \frac{\text{Total feed intake (g)}}{\text{Total number of days of the experiment}}$$

### **Body Weight Gain**

Rabbits in each replicate were weighed at the start of experiment and then weighed at the end of each subsequent week for 8 weeks of the experiment. Body weight gain was calculated from the difference between the body weight for the given week and that of the previous week. Final weight was taken and recorded at the end of the experiment.

$$\text{Total body weight gain (g)} = \text{Final body weight (g)} - \text{Initial body weight (g)}$$

$$\text{Daily body weight gain (g)} = \frac{\text{Final body weight (g)} - \text{Initial body weight (g)}}{\text{Total number of days of the experiment}}$$

### **Feed Conversion Ratio**

This was calculated as feed intake per body weight gain.

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed consumed (g)}}{\text{Total body weight gain (g)}}$$

### **Mortality**

Mortality was recorded as it occurs.

### **Data Analysis**

Data collected were subjected to analysis of variance in completely randomised design using SPSS package version 20, differences between means were separated using Duncan's Multiple Range Test.

## **RESULTS AND DISCUSSION**

### **Effect of Tiger nut Residue on Growth Performance of Rabbit**

The results showed no significant differences ( $P>0.05$ ) in the final weight of the rabbits across all treatment groups. Rabbits fed diet 0% (1096.50g) had the highest final weight, followed by those on diet 6% (1051.33g), while rabbits fed diet 2% (952.17g) recorded the lowest final weight. Despite the numerical differences, the statistical similarity ( $P>0.05$ ) suggests that tiger nut residue inclusion up to 8% does not adversely affect the final body weight of growing rabbits. This finding indicates that tiger nut residue can be successfully incorporated into rabbit diets without compromising growth performance (Nathaniel *et al.* 2023; Ani, 2006). The daily weight gain pattern showed comparable results across all treatment groups, with no significant differences ( $P>0.05$ ) observed. The similarity in daily weight gain across treatments suggests that tiger nut residue inclusion levels tested in this study were well-tolerated by the rabbits and did not impair their growth potential (Nathaniel *et al.* 2023; Alu, 2015). This could be attributed to the adequate nutritional profile of tiger nut residue, which contains essential nutrients required for optimal rabbit growth (Lebas *et al.*, 1997). The feed conversion ratio showed no significant differences ( $P>0.05$ ) among the treatment groups, indicating efficient feed utilization across all dietary treatments. However, the statistical similarity suggests that tiger nut residue inclusion does not negatively impact feed conversion efficiency. According to Ferket and Gernat (2006), feed conversion ratio is the ultimate productivity parameter used to assess animal performance. The comparable feed conversion ratios obtained in this study indicate that tiger nut residue can be incorporated into rabbit diets without compromising feed utilization efficiency. Daily feed intake was statistically similar ( $P>0.05$ ) across all treatment groups, ranging from 58.20g in 8% to 68.61g in 6%. This similarity in feed intake among treatment groups suggests that tiger nut residue inclusion did not affect the palatability or acceptability of the diets (Abdullahi *et al.*, 2022). The comparable feed intake indicates that the fiber content of tiger nut residue did not significantly influence consumption patterns, unlike what has been reported with excessive fiber levels in rabbit

diets (Belewu and Belewu, 2007). The maintained feed intake across treatments suggests that tiger nut residue can be included up to 8% without adverse effects on voluntary feed consumption.

The overall performance indicates that tiger nut residue can be successfully incorporated into rabbit diets up to 8% inclusion level without detrimental effects on growth performance. This finding is consistent with previous studies that reported successful utilization of alternative feed ingredients in rabbit production systems (Nsa *et al.*, 2010). The ability to maintain comparable growth performance across all treatment groups suggests that tiger nut residue has potential as a partial substitute for conventional feed ingredients in rabbit diets, particularly during periods of feed scarcity or high feed costs.

**Table 2:** Growth Performance of Grower Rabbits Fed Graded Level of Tiger Nut Residue

Parameters	T1	T2	T3	T4	T5	SEM	P-value
Initial weight (g)	316.67	283.33	333.33	333.33	283.33	16.33	0.807
Final weight (g)	1096.50	952.17	1005.33	1051.33	1037.00	45.22	0.921
Daily weight gain (g)	13.93	11.91	12.00	12.82	11.88	0.51	0.734
Daily feed intake (g)	68.49	65.36	65.14	68.61	58.20	1.20	0.090
Feed conversion ratio	4.99	5.55	5.55	5.40	5.28	0.26	0.973

SEM - Standard error of means

#### ECONOMIC ANALYSIS OF TIGER NUT RESIDUE INCLUSION IN RABBIT DIETS

The economic analysis reveals important cost implications of incorporating tiger nut residue in rabbit diets. Feed cost per kilogram decreased progressively with increasing levels of tiger nut residue inclusion, ranging from ₦173.56/kg for the control diet (0%) to ₦159.68/kg for the 8% inclusion level (8%). This reduction in feed cost can be attributed to the lower cost of tiger nut residue compared to conventional feed ingredients, making it an attractive option for reducing production costs in rabbit farming operations (Archibong *et al.*, 2018). The total feed cost followed a similar pattern, with 8% (8% inclusion) recording the lowest total feed cost of ₦536.52, representing a 19.5% reduction compared to the control diet (₦666.47). This substantial cost reduction agrees with study of Ojebiyi, *et al.* (2024), who emphasized the importance of utilizing locally available feed resources to reduce production costs in livestock farming. The progressive decrease in feed costs with increasing tiger nut residue inclusion suggests that this by-product has significant potential as a cost-effective feed ingredient in rabbit production systems. Despite the reduction in absolute feed costs, the economic efficiency measured by feed cost per kilogram of weight gain presents a more complex picture. The control diet (0%) achieved the most economical feed conversion at ₦854.45 per kilogram of weight gain, while 2% (2% inclusion) recorded the highest cost at ₦929.15 per kilogram of weight gain. Interestingly, 8% (8% inclusion) showed the second-best economic efficiency at ₦800.78 per kilogram of weight gain, indicating that higher inclusion levels may offer better economic returns despite potentially reduced growth performance. The finding is consistent with observations by Alu, (2015), who noted that the economic value of alternative feed ingredients in rabbit diets depends not only on their cost but also on their effect on animal performance. The improved economic efficiency observed at 8% inclusion level suggests that the cost savings from using tiger nut residue can offset any marginal reduction in growth performance, making it economically viable for commercial rabbit production.

**Table 3:** Economic Analysis of Grower Rabbits Fed Graded Level of Tiger Nut Residue

Parameters	T1 (0%)	T2 (2%)	T3(4%)	T4(6%)	T5(8%)
Total feed intake (kg)	3.84	3.66	3.65	3.84	3.36
Feed cost (₦/kg)	173.56	170.09	166.62	163.15	159.68
Total feed cost (₦)	666.47	622.53	608.16	626.49	536.52
Total weight gain (kg)	0.78	0.67	0.67	0.72	0.67
Feed cost (₦/kg gain)	854.45	929.15	907.70	870.13	800.78





## CONCLUSION AND RECOMMENDATIONS

The inclusion of tiger nut residue in rabbit diets up to 8% demonstrated no adverse effect on growth performance parameters such as feed intake, body weight gain, and feed conversion efficiency. The comparable performance across all treatments indicates that tiger nut residue possesses adequate nutritional quality to support rabbit growth.

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