EFFECTS OF BREED ON MORPHOMETRIC TRAITS OF THREE BREEDS OF RABBIT FED TIGERNUT PELLETIZED DIETS

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ABSTRACT
An 100-days experimental research was conducted to evaluate the effect of breed on morphometric traits of one hundred and forty six (146) weaned rabbits from forty-eight (48) does and twelve (12) bucks consisting of three different breeds namely; Hyla, Newzealand white and Dutch. The rabbits were equally allotted into treatments comprising of all the experimental breeds. Tiger nut (*Cyperus esculentus*) was mixed with other feed ingredients to form four (4) experimental diet of; Treatment 0, 1, 2 and 3 with the inclusion levels of 0(control), 10, 20 and 30g respectively of tiger nut per 1kg of feed. The rabbits were randomly allotted to the experimental diets in 3x4 factorial arrangements in a Completely Randomized Design (CRD). Body linear measurements data were taken on the 146 rabbit kittens at first and fifth week (weaning) as follow; body length (BL), height at withers (HW), ear length (EL), heart girth (HG), shoulder to tail length (STL), fore-leg length (FL), tail length (TL), rump height (RH). The results showed that tiger nut diets recorded significant ($P < 0.05$) effect across all the inclusion levels on almost the linear body parameters both for first and fifth week likewise effect of breed on morphometric measurements of rabbit showed significant ($P < 0.05$) influence on body length and other morphometric traits at week 1 while at week 5 there existed no significant ($P>0.05$) effect of the breeds on morphometric traits except for EL. However, at week 1, the interaction of 0, 10, 20, 30g inclusion with the three breeds, has a significant ($P < 0.05$) effect on BL, STL, TL, HL, HW, FL, HL and HW, RUMP. It was observed that NZW has the highest significant difference at 30g inclusion and this may be as a result of high inclusion level of tiger nut in the tested meal. However, observing 10g interaction with the breeds of rabbit at week 5, there was significant ($P < 0.05$) influence on EL, STL and FL. At 30g inclusion level in relations with the breeds showed there was no significant ($p>0.05$) differences existed among all the morphometric traits except for TL. It was concluded that breed had a significant higher performance on linear body measurements of rabbit at 30g tiger nut inclusion level. Based on the results of this research, the inclusion level of tiger nut based diet at 30% is recommended for optimum performance at first week for Newzealand white, followed by Hyla and Dutch.
Keywords: Rabbits, Tiger nut, Breed and Morphometric traits.

INTRODUCTION

Body conformation, breed and size are important traits in animals used for meat production. Relating body weight to linear body measurements is one way of predicting body weight of rabbits (Isaac *et al*., 2011). This is relevant especially in rural communities where there is an evidence for absence of conventional weighing scales. The relationships among quantitative traits such as body weight, body length, ear length, tail length and limb lengths etc. have been investigated among domestic rabbits (Chineke *et al*., 2002). Simple linear body measurements that can readily predict body weight without rabbit slaughter is therefore highly desirable as it will ensure the selection of animals that will reach market weight and size at relatively faster rate. It will also serve as a tool for breeders in selecting animals destined for use as breeding stock (Atansuyi *et al*., 2011).

According to Bamishaiye (2011) and Sanchez-Zapata (2012), tiger nut (*Cyperus esculentus*) is an underutilized crop of the family Cyperceae, that produce rhizomes from the based and tubers which contain soluble glucose of about 21%. Tiger nut is classified as a medicinal crop due to its been highly energetic and diuretic, rich in mineral, predominantly phosphorus and potassium and also vitamins C and E (Abaejoh *et al*., 2006).

However, there is limited information on the comparison of linear body measurement traits in Hyla, NewZealand White and Dutch breeds of rabbit at different ages. Hence, the objective of the study was to evaluate the effect of breeds and sex on morphometric traits of three breeds of rabbit fed tiger nut pelletized diet.

Materials and methods

Location of study

This research work was carried out at the Rabbitry Unit of the Teaching and Research Farm of the Federal University of Technology, Akure, Ondo State, Nigeria. The study location lies in the humid rain forest zone of Western Nigeria which is characterized by two rainfall peaks and high humidity during the raining season. The mean annual rainfall is about 1,500mm which last for nine months between March and November. The relative humidity is over 75% and that of temperature is about 27^{o}C (Climate data, 2018).

Experimental diet and formula

A tiger nut pelletized base diet was formulated with feed to meet the nutrient requirement of the rabbits. The tiger nut (*Cyperus esculentus*) was mixed with other ingredients to form four (4) experimental diets at levels of 0, 10, 20 and 30g/kg. The chemical composition of the diet consisted of 2500kcal kg^{-1} metabolisable energy, 15% crude protein, 8% ash, 12% fiber, 2% ether extract, 7.89% moisture content and 92.11% dry matter.

Experimental animals, housing and management

A total of One hundred and forty six (146) rabbit kittens weaned from forty-eight (48) does and twelve bucks (12) comprising of Hyla, NewZealand White and Dutch breed were used in this study. The sexually matured does and bucks were allowed to adjust in rabbitry for two weeks and within this period; they were placed on the test diet for two weeks before the actual commencement of mating. During the gestation and lactating period, the does were fed on tiger nut pelletized diet, so as well the kittens had access to the feeding trail in their various treatment and they were given extra feeders and drinkers at 12 days of age . The experiment which lasted for One hundred days.

Data collection

Linear body measurements of each rabbit kits were recorded carefully according to the method of Egena *et al.* (2012). The data were recorded weekly from day-7 till weaning (day-35). The linear body measurements were taken using measuring tape. All measurements (cm) description include: BW = Body weight; BL = Body length; HW= Height at withers; EL= Ear length; HG = Heart girth; STL= shoulder to tail length; FL= Fore limb; TL = Tail length; HL = Head length; RUMP = Rump.

Statistical analyses

All data generated were analyzed using SAS 2019 (Version 9.2) software package. The following model was used in this study to determine the effect of breed and sex on the morphometric traits. All the statistical analysis was performed at the 5% significance level. The model used was $Y_{ijk} = \mu + B_i + D_j + (BD)_{ij} + e_{ijk}$

Where: Y_{ijk} = individual observation
μ = overall mean
B_i = fixed effect of i^{-th} breed (i = 1, 2, 3)
D_j = random effect of the diet (1, 2, 3, 4)
BD_{ij} = interaction between breed and diet
e_{ijk} = residual error

RESULTS AND DISCUSSIONS

The least square means and standard errors of morphometric traits as affected by breeds and tiger nut inclusions at 1st week was revealed in table 1. The results showed that tiger nut diets recorded significant ($P < 0.05$) effect across the inclusion levels on all the linear body parameters except for FL and HL as agreed in the study of Adenkola *et al*. (2009) that dietary treatment of tiger nut significantly affected both physiological state and linear growth of rabbit. Effect of breed on morphometric measurements of rabbit as presented on the table showed significant difference ($P < 0.05$) for BL, TL, HL and Rump. Similar result was reported by Sam *et al.* (2020) who observed significant ($P < 0.01$) difference between morphometric measurements and breed of Chinchilla and New Zealand White. The non-significant ($P > 0.05$) difference obtained for HW, EL, HG, STL and FL may be due to genetic closeness of breeds of rabbit and this agrees with the result of Obaso *et al.* (2019) and Sam *et al.* (2020). For the interaction between tiger nut inclusion levels and the three breeds, it was observed that no significant ($P > 0.05$) difference of 0g inclusion on Hyl, NZW and DUT on all the morphometric parameters except on HL and Rump. For 10g and inclusion on the three breeds, there was significant ($P < 0.05$) difference on STL, TL and HL, BL, HW and HW which could be as a result of the fibre content which contributed to efficient feed conversion that lead to their growth. However, at 30g inclusion level in relations to the three breeds there was significant ($p<0.05$)

differences among all the morphometric traits except for HW, EL, STL and TL. It was observed that NZW has the highest significant difference at 30g inclusion and this may be as a result of high inclusion level of tiger nut in the tested meal.

Table 1: Least square means and standard errors of morphometric parameters as affected by breeds and tiger nut inclusions at 1st Week

Factors		**Morphometric traits**								
		BL	HW	EL	HG	STL	FL	TL	HL	RUMP
Diet	**0g**	20.07±0.45^{a}	13.44±0.27^{a}	3.48±0.11^{bc}	11.69±0.22^{a}	16.12±0.35^{a}	6.87±0.14	2.23±0.18^{a}	6.30±0.14	10.21±0.24^{a}
	10g	18.77±0.30^{b}	12.08±0.16^{c}	3.71±0.12^{b}	10.52±0.14^{c}	14.41±0.28^{b}	6.76±0.12	1.86±0.06^{b}	6.13±0.10	9.80±0.22^{ab}
	20g	19.58±0.44^{ab}	12.62±0.14^{bc}	3.22±0.09^{c}	11.02±0.15^{b}	14.90±0.28^{b}	6.97±0.14	1.80±0.04^{b}	6.09±0.13	9.38±0.18^{b}
	30g	20.25± 0.43^{a}	13.01±0.25^{ab}	4.04±0.12^{a}	11.66±0.21^{a}	15.09±0.32^{b}	7.10±0.16	2.05±0.07^{ab}	5.96±0.12	9.92±0.23^{ab}
Breed	**HYL**	20.19±0.36^{a}	12.74±0.21	3.62±0.14	11.34±0.18	15.21±0.27	7.02±0.11	2.18±0.15^{a}	6.04±0.09^{b}	9.78±0.18^{ab}
	NZW	19.69±0.36^{ab}	12.99±0.20	3.64±0.08	11.26±0.18	15.13±0.27	6.87±0.14	1.89±0.04^{b}	6.40±0.11^{a}	10.23±0.16^{a}
	DUT	19.17±0.34^{b}	12.56±0.18	3.62±0.10	11.02±0.16	14.97± 0.29	6.90±0.11	1.91±0.05^{b}	5.91±0.10^{b}	9.50±0.21^{b}
Interaction										
0g	**HYL**	20.32±0.97	13.29±0.61	3.15±0.12	11.70±0.43	15.65±0.59	6.92±0.22	2.56±0.60	6.32±0.24^{ab}	10.73±0.34^{a}
	NZW	21.00±0.85	13.78±0.46	3.58±0.15	11.90±0.34	16.53±0.65	6.80±0.33	2.17±0.07	6.78±0.23^{a}	10.73±0.30^{a}
	DUT	18.93±0.40	13.22±0.37	3.65±0.25	11.46±0.40	16.10±0.60	6.90±0.10	2.01±0.07	5.80±0.17^{b}	9.26±0.43^{b}
10g	**HYL**	19.84±0.77	12.09±0.21	3.83±0.35	10.69±0.26	14.78±0.68^{b}	6.95±0.28	2.13±0.15^{a}	5.90±0.20^{b}	9.58±0.28
	NZW	18.56±0.34	12.42±0.31	3.77±0.14	10.71±0.18	14.25±0.22^{a}	6.49±0.18	1.72±0.18^{b}	6.45±0.18^{a}	10.08±0.27
	DUT	18.47±0.52	11.79±0.23	3.61±0.20	10.28±0.25	14.37±0.55^{b}	6.91±0.18	1.86±0.11^{ab}	5.96±0.13^{ab}	9.66±0.44
20g	**HYL**	20.42±0.70^{a}	12.56±0.22^{ab}	3.03±0.19	11.04±0.33^{ab}	15.16±0.60	7.16±0.25	1.83±0.08	6.10±0.22	9.03±0.40
	NZW	17.96±0.34^{b}	12.30±0.19^{b}	3.23±0.17	10.46±0.20^{b}	14.13±0.29	6.57±0.29	1.72±0.06	5.92±0.25	9.23±0.25
	DUT	20.50±0.93^{a}	12.98±0.28^{a}	3.36±0.12	11.56±0.18^{a}	15.45±0.50	7.22±0.16	1.86±0.05	6.25±0.21	9.83±0.27
30g	**HYL**	20.14±0.58^{ab}	12.85±0.40	4.32±0.26	11.70±0.30^{ab}	15.18±0.39	7.02±0.1^{b}	2.19±0.10	5.87±0.08^{b}	9.75±0.24^{b}
	NZW	21.71±0.77^{a}	13.65±0.45	3.95±0.18	12.20±0.44^{a}	15.89±0.64	7.78±0.1^{a}	1.99±0.09	6.43±0.13^{a}	10.99±0.27^{a}
	DUT	19.12±0.74^{b}	12.63±0.45	3.85±0.17	11.15±0.33^{b}	14.32±0.56	6.61±0.3^{b}	1.95±0.14	5.65±0.29^{b}	9.20±0.45^{b}

^{a,b,c} – Means on the same column having different superscripts are significantly different (P<0.05).

0g, 10g, 20g and 30g = 0gram, 10grams,20grams and 30grams Tiger nut inclusion level; HYL = Hyla; NZW = New Zealand White; DUT = Dutch; BL = Body length; HW= Height at withers; EL= Ear length; HG = Heart girth; STL= shoulder to tail length; FL= Fore limb; TL = Tail length; HL = Head length; RUMP = Rump

The least square means and standard errors of morphometric traits as affected by breeds and tiger nut inclusions at 5th week revealed in table 2. The results showed that tiger nut diets recorded significant ($P < 0.05$) effect across all the inclusion levels on all the linear body parameters except for STL and HL which was in accordance with the observations made for 1st week. More so, there existed no significant ($P>0.05$) effect of the breeds of rabbit on morphometric traits except for EL which was not in line with observation of Adamu *et al*. (2021) that observed significant effect of breed on morphometric traits like EL and TL. However, observing interaction of 0g, 10g and 30g tiger nut inclusion and the three breeds, there was significant difference on EL, STL, TL and FL.

Table 2: Least square means and standard errors of morphometric parameters as affected by breeds and tiger nut inclusions at 5th Week

factors		Morphometric traits								
		BL	HW	EL	HG	STL	FL	TL	HL	RUMP
Diet	**0g**	26.89±0.43^{a}	17.49±0.41^{a}	7.06±0.11^{b}	15.84±0.27^{a}	20.51±0.49	10.64±0.13^{ab}	4.79±0.10^{b}	9.77±0.11	14.74±0.18^{a}
	10g	25.25±0.25^{b}	16.55±0.16^{b}	7.57±0.12^{a}	15.03±0.18^{b}	19.63±0.36	10.42±0.12^{b}	4.84±0.11^{ab}	9.79±0.18	14.04±0.21^{b}
	20g	26.34±0.40^{a}	16.46±0.21^{b}	7.39±0.12^{a}	15.30±0.15^{ab}	19.66±0.32	10.47±0.11^{ab}	5.08±0.10^{ab}	9.99±0.15	14.21±0.17^{ab}
	30g	27.03±0.44^{a}	17.83±0.32^{a}	7.50±0.10^{a}	15.74±0.34^{ab}	20.89±0.44	10.79±0.11^{a}	5.16±0.15^{a}	9.76±0.11	14.45±0.26^{ab}
Breed	**HYL**	26.68± 0.35	16.99± 0.26	7.40±0.10^{ab}	15.60±0.27	20.23± 0.37	10.70±0.10	4.97± 0.09	9.83±0.09	14.58±0.21
	NZW	26.20± 0.36	17.10± 0.29	7.20± 0.09^{b}	15.40±0.20	19.93± 0.35	10.46±0.11	5.07± 0.13	9.65±0.12	14.33±0.15
	DUT	26.21± 0.32	17.10± 0.23	7.56±0.11^{a}	15.41±0.19	20.32± 0.35	10.59±0.09	4.87±0.09	9.98±0.14	14.19±0.19
Interaction										
0g	**HYL**	26.47±0.70	16.99±0.76	7.09±0.19	15.78±0.39	19.80±0.78	10.64±0.22	4.64±0.22	9.94±0.16	14.62±0.21
	NZW	27.07±0.79	17.66±0.68	6.80±0.15	15.57±0.45	20.60±0.82	10.57±0.24	4.88±0.19	9.45±0.21	14.90±0.25
	DUT	27.08±0.75	17.75±0.72	7.29±0.23	16.18±0.56	21.01±0.93	10.71±0.23	4.82±0.10	9.96±0.17	14.68±0.42
10g	**HYL**	25.85±0.48	16.61±0.38	7.83±0.19^{a}	15.58±0.23	20.73±0.89^{a}	10.85±0.29^{a}	5.21±0.30	10.10±0.24	14.59±0.43
	NZW	24.64±0.35	16.61±0.34	7.15±0.15^{b}	15.06±0.37	18.53±0.23^{b}	10.03±0.18^{b}	4.65±0.17	9.46±0.11	13.61±0.18
	DUT	25.50±0.42	16.47±0.17	7.81±0.20^{a}	14.76±0.22	20.07±0.64^{ab}	10.55±0.17^{ab}	4.84±0.17	9.93±0.38	14.16±0.40
20g	**HYL**	26.98±0.74	16.55±0.33	7.06±0.11	15.17±0.31	19.18±0.62	10.60±0.17	5.00±0.08	9.54±0.15	14.69±0.30
	NZW	25.71±0.59	16.03±0.40	7.53±0.22	15.25±0.27	19.89±0.66	10.47±0.23	5.22±0.20	10.08±0.32	14.07±0.29
	DUT	26.45±0.76	16.80±0.32	7.53±0.22	15.46±0.24	19.82±0.39	10.37±0.16	5.01±0.20	10.28±0.21	13.95±0.27
30g	**HYL**	27.12±0.74	17.56±0.47	7.64±0.18	15.82±0.78	21.06±0.63	10.73±0.17	5.05±0.12^{ab}	9.81± 0.15	14.45±0.56
	NZW	27.93±0.84	18.34±0.72	7.36±0.13	15.85±0.52	21.14±0.92	10.93±0.21	5.70±0.38^{a}	9.67±0.30	14.96±0.28
	DUT	26.17±0.70	17.66±0.52	7.48±0.20	15.56±0.42	20.± 0.81	10.75±0.18	4.83±0.21^{b}	9.78±0.16	14.02±0.40

^{a,b,c} – Means on the same column having different superscripts are significantly different (P<0.05).

0g, 10g, 20g and 30g = 0gram, 10grams,20grams and 30grams Tiger nut inclusion level; HYL = Hyla; NZW = New Zealand White; DUT = Dutch; BL = Body length; HW= Height at withers; EL= Ear length; HG = Heart girth; STL= shoulder to tail length; FL= Fore limb; TL = Tail length; HL = Head length; RUMP = Rump

Conclusion and Recommendation

It is therefore recommended that 10 to 30g of tiger nut pelleted diet be used for rabbits. Furthermore, more investigations should be carried out using more data set.

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