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The Growth Performance and Linear Body Measurements of Mongrel Rabbits in a Tropical Environment

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study investigates the growth performance and linear body measurements of mongrel rabbits raised under tropical conditions, providing empirical evidence for their viability as a sustainable protein source in Nigeria. A total of sixty progenies were used to evaluate growth traits comprising of body weight and linear body parameters in mongrel rabbits, estimate phenotypic correlations among growth traits and develop regression models to predict body weight using linear body measurements. Body weight and linear body measurements comprising; Ear length, Heart girth, Body length, Fore-limb, Hind limb and Tail length were taken from 8 weeks to 16 weeks of age. Results showed that age exerted ($P < 0.05$) significant influence on all growth traits. During the study period, a positive and substantial correlation was found between body weight and all linear body parameters. This implies that, an improvement in any of linear parameters will bring about an improvement in body weight vice versa. Body weight was significantly predicted using linear body measurements with high to medium degree of validity. Higher validity was observed in the multiple model when more traits where fitted into the prediction equation.

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1. INTRODUCTION

Nigeria alongside several nations in sub-Sahara Africa is faced with food insecurity and under nourishment. FAO (2020), reported that though the food insecurity is a worldwide issue, it is rather in the increase in sub- Sahara Africa. FAOSTAT (2019), observed that Nigeria's per capita food supply of animal source which are superior protein sources is 8 liters of milk, 9kg of meat and 3.5kg of eggs per year with a consumption levels of milk and meat lower than the continental averages of 44 liters and 19kg respectively. Thus, it may be concluded that Nigeria faces the same problem of inadequate protein intake. In addition, Nigeria's growing urbanization and population make the issue worse (FAO 2017).

Livestock farming provides a means of improving food insecurity and insufficient animal protein in Nigeria (Ayeni et al., 2023). Protein from livestock which are not readily considered in animal husbandry are being explored (Obasi et al., 2019). Domestic rabbits falls in this category, and is of advantage due to its; fast growth rate, ability to convert 20% forage to meat, short gestation period, high prolificacy, high protein level (20.8- 21.3 %), rich in vitamins and minerals, low in sodium, fat, and cholesterol, making it of high nutritive value (Rotimi and Ati, 2020; Sanah et al., 2022; Siddiqui et al., 2023). They have a short generation interval and the ability to thrive on diverse feed resources, making them an attractive option for smallholder and commercial farming systems (Lebas et al., 1997). Among rabbit breeds, mongrel rabbits—characterized by their mixed genetic background—are increasingly considered in tropical regions due to their presumed adaptability and resilience to environmental stressors (Hassan et al., 2020). Growth in all animals is a complex process controlled by both genetic and non-genetic factors. The tropical environment, while conducive to agriculture, presents significant challenges for livestock production, particularly due to high ambient temperatures, humidity, and seasonal variability (Marai et al., 2001). Heat stress, a prominent factor in tropical climates, disrupts thermoregulation, leading to reduced growth performance, decreased fertility, and compromised animal welfare (Rashwan & Marai, 2000). Although the growth performance of an animal is a phenotypic attribute influenced by the environment, to a large extent however, it is a manifestation of the genetic constitution of the animal (Oleforuh-Okoleh et al., 2017).

While commercial rabbit breeds such as New Zealand White and Californian have been extensively studied, there is limited information on the performance of mongrel rabbits, which may harbor genetic advantages from hybrid vigor (heterosis) that enhance their adaptability to harsh environments (Ajayi et al., 2021). Mongrel rabbits could exhibit better resilience to tropical stressors, but this hypothesis requires empirical validation. Growth performance and body conformation traits are important parameters in assessing the potential of genetic improvement and development of mongrel rabbits to enhance their contribution to the much-needed animal protein in Nigeria (Adeoluwa and Adebayo, 2020). Morphological variation within species is of great biological interest both as descriptive and analytical tool (Hallgrimsson et al.,2011). Sexual dimorphism on morphological traits is important in descriptive studies to characterize population composition and evaluate the genetic variation within and between populations of rabbits (Lukefahr and Cheeke,1991; Lebas et al.,1997; Akinola and Onwuka, 2016). Correlations expresses the relationships between phenotypic values of the animals, which could be seen on the performance of the animals. The knowledge of the relationships between body weight and growth traits (correlation) are useful tools for breeders in selecting animals as breeding stock and for predicting body weight (Udoh and Udofot, 2016). Obasi *et al*. (2019) reported positive and significant phenotypic correlations between linear body measurements and bodyweight indicating that an improvement in one trait would lead to a corresponding improvement in the other provided environmental influence is excluded.

Thus, the knowledge obtained will be essential in planning breeding programmes and in adopting breeding strategies

2. MATERIALS AND METHODS

2.1 Location

The experiment was carried out at the Rabbit Unit of the department of Animal Science, University of Uyo, Akwa Ibom State, Nigeria. The farm is located in the tropical rain forest, vegetation zone of Southern Nigeria lying between longitude $7^0$91'N and latitude $5^0$04'E with an altitude of 64m temperature at maximum was about (State here e.g 30^0 C and minimum of 24^0 C). Annual rainfall is about 2000 - 3000 mm (Wikipedia). The state is bounded in the North by Abia State, South by the Atlantic Ocean, East by Cross River State and West by Rivers State.

2.2 Experimental Animals and Management

A total of 60 weaner mongrel rabbits comprising of 30 males and 30 females were used for the study. Animals were acclimatized for 2 weeks before the commencement of the experiment during which, they were observed for any clinical abnormalities. Rabbits were housed individually in three-tier wooden hutches of 60 cm x 60 cm and 60 cm from the ground. The hutches were thoroughly washed with detergent and disinfected a week before the arrival of the rabbits. Tag numbers were assigned to each hutch and each rabbit was systematically ear numbered with a permanent marker for easy identification. Concrete drinkers and feeders were provided. Rabbits were fed *ad libitum* with grower's mash (top feed) and supplemented with forages such as *Centrosema pubescens*, and *Pannicum maximum* as suggested by Obasi et al., (2019). Clean water was provided daily.

Prophylactic medications were administered to weaning rabbits against prevalent rabbit infections such as, coccidiosis, mucoid enteritis, pasteurellosis, etc. Multivitamins were administered in drinking water to boost appetite.

2.3 Data Collection

The following data were collected:

1. Body weight of the kittens were measured weekly using sensitive scale weighing balance (top loading pan scale of 20 kg capacity with 0.01 kg accuracy) and recorded in (g) from 8 weeks to 16 weeks.
2. Linear body measurements comprising of:

a) Body length: length between the neck region to the base of the tail (cm).
b) Heart girth: body circumference of chest region (cm).
c) Length of forelimb: length from the base of ulna bone to the tip of the feet (cm).
d) Length of hind limb: length from the base of the pelvic bone to the tip of the feet (cm).
e) Tail length: length from the base to the tip of tail (cm).
f) Ear length: length from the base to the tip of ear (cm); were measured weekly from 8 weeks to 16 weeks using tailor's tape. All measurements were taken in the morning before feeding and by the same person to avoid variations.

2.4 Experimental Design

Data collected were subjected to analysis of variance in CRD using SPSS, significant means were separated by DMRT.

The general linear model for the experiment was: $Y_{ij}=\mu+S_i+e_{ij}$.

Where;

Y_{ij}…. individual observation
μ …. general mean
S_i …. effect of i^{th} sex (1,2)
e_{ij}…. residual error

3. RESULTS AND DISCUSSION

The growth performance and linear body measurements of mongrel rabbits across five different age intervals (week 8, 10, 12, 14, and 16) are summarized in Table 1. There was a consistent and significant increase ($p < 0.05$) in all parameters measured as the rabbits aged.

Body weight significantly ($p < 0.05$) increased from 501.83 ± 9.67 g at week 8 to 1300 ± 16.35 g at week 16. This conforms to the report of Onasanya et al., (2017) who observed that body weight proportionately increases with an increase in age. Lamptey et al., (2022) also noted that rabbits have progressive growth which is more rapid at the early stage of growth. Similarly, linear body measurements followed a progressive and significant ($p < 0.05$) upward trend across the weeks. This agrees with the findings of Sam et al., (2020) who observed that linear body measurements increased as body weight increased. The result implies that growth is influenced by age. Ear length increased from 8.36 ± 0.06 cm at week 8 to 10.62 ± 0.05 cm at week 16. Heart girth expanded steadily from 16.76 ± 0.13 cm at week 8 to 24.88 ± 0.20 cm at week 16, indicating a proportional increase in body mass.

Body length rose from 30.60 ± 0.18 cm at week 8 to 39.89 ± 0.24 cm at week 16. This is lower than

34.95 ± 4.42 cm obtained by Ologbose et al., (2017) but higher than 17.12 ± 1.06 cm and 18.86 ± 0.24 cm obtained by Sam et al., (2020). Whilst the forelimb and hind limb lengths increased from 10.88 ± 0.06 cm and 15.47 ± 0.10 cm at week 8 to 14.74 ± 0.10 cm and 21.42 ± 0.14 cm, respectively, at week 16. Tail length also exhibited significant growth, increasing from 6.66 ± 0.06 cm at week 8 to 8.98 ± 0.06 cm at week 16.

The consistent increases in these parameters align with previous findings, where body weight and linear measurements significantly correlate with age in growing rabbits (Yakubu et al., 2010). The significant increments observed in heart girth, body length, and limb measurements suggest enhanced skeletal and muscular development over time, critical for genetic improvement programs and meat production.

The increase in ear length could be linked to physiological adaptations to thermoregulation in rabbits, as previously noted by Etim et al. (2014). Additionally, the steady rise in tail length and limb measurements is consistent with findings by Oke et al. (2018), who emphasized the role of these traits in evaluating growth performance and body conformation.

This progressive growth pattern highlights the potential of rabbits for improving animal protein availability, particularly in regions like Nigeria, where animal protein deficiency is prevalent (Lebas et al., 1997). The observed trends also provide a foundation for further genetic selection and breeding strategies to enhance rabbit production efficiency.

The Average Daily Gain (ADG) of mongrel rabbits for various body parameters during different age intervals (Weeks 8–10, 10–12, 12–14, and 14–16) is presented in Table 2. The findings highlight significant differences ($p < 0.05$) across the measured parameters within each growth phase.

The body weight showed a significant increase from week 8–10 (13.06 ± 0.39 g) to Week 10–12 (15.16 ± 0.48 g) before slightly declining during week 12–14 (13.83 ± 0.54 g) and then rising again during Week 14–16 (15.10 ± 0.62 g). This pattern indicates growth spurts influenced by environmental and nutritional factors, as described by Nwakalor et al. (2017). The observed fluctuations suggest that external stressors, such as temperature and humidity, might have impacted feed intake and metabolic efficiency.

Table 1. Body weight and linear body measurements for week 8, 10, 12, 14 and 16

	Mean ± SEM				
	Week 8	**Week 10**	**Week 12**	**Week 14**	**Week 16**
Body Weight	501.83 ± 9.67^{e}	684.67 ± 10.95^{d}	896.92 ± 13.05^{c}	1088.67 ± 15.32^{b}	1300 ± 16.35^{a}
Ear Length	8.36 ± 0.06^{e}	8.85 ± 0.58^{d}	9.63 ± 0.06^{c}	10.13 ± 0.05^{b}	10.62 ± 0.05^{a}
Heart Girth	16.76 ± 0.13^{e}	18.41 ± 0.13^{d}	21.10 ± 0.14^{c}	22.88 ± 0.16^{b}	24.88 ± 0.20^{a}
Body Length	30.60 ± 0.18^{e}	32.88 ± 0.17^{d}	35.38 ± 0.18^{c}	37.36 ± 0.18^{b}	39.89 ± 0.24^{a}
Fore limb	10.88 ± 0.06^{e}	11.66 ± 0.07^{d}	12.74 ± 0.89^{c}	13.69 ± 0.08^{b}	14.74 ± 0.10^{a}
Hind Limb	15.47 ± 0.10^{e}	16.70 ± 0.10^{d}	18.36 ± 0.10^{c}	19.89 ± 0.13^{b}	21.42 ± 0.14^{a}
Tail length	6.66 ± 0.06^{e}	7.33 ± 0.52^{d}	7.98 ± 0.57^{c}	8.49 ± 0.06^{b}	8.98 ± 0.06^{a}

a,b,c = means in a row within a parameter with different superscripts are significantly (p<0.05) different from each other

Table 2. Average Daily Gain of Mongrel Rabbit

	Mean ± SEM			
Parameters	**Week 8 – 10**	**Week 10- 12**	**Week 12-14**	**Week 14 – 16**
Body Weight	13.06 ± 0.39^{b}	15.16 ± 0.48^{a}	13.83 ± 0.54^{ab}	15.10 ± 0.62^{a}
Ear Length	0.04 ± 0^{b}	0.06 ± 0^{a}	0.04 ± 0.01^{b}	0.04 ± 0^{b}
Heart Girth	0.12 ± 0.01^{c}	0.19 ± 0.01^{a}	0.13 ± 0.03^{ab}	0.14 ± 0.16^{b}
Body Length	0.16 ± 0.01^{ab}	0.18 ± 0.01^{a}	0.14 ± 0.04^{b}	0.18 ± 0.01^{a}
Fore limb	0.06 ± 0^{b}	0.08 ± 0^{a}	0.07 ± 0.02^{ab}	0.08 ± 0.01^{a}
Hind Limb	0.09 ± 0^{b}	0.12 ± 0^{a}	0.11 ± 0.02^{a}	0.11 ± 0.01^{a}
Tail length	0.05 ± 0^{a}	0.05 ± 0^{a}	0.04 ± 0.01^{b}	0.04 ± 0^{b}

a b c = means in a row within a parameter with different superscripts are significantly different

The ear length increased significantly during Week 10–12 (0.06 ± 0), remaining stable during other weeks at 0.04 ± 0–0.04 ± 0.01. The significant increase in ear length during Weeks 10-12 may reflect the rabbits' physiological maturity during this period, which is consistent with the findings of Igwe et al. (2019), who noted that external morphological features are frequently indicative of growth performance and thermoregulation capacity.

The heart girth demonstrated its peak growth during Weeks 10–12 (0.19 ± 0.01) compared to other intervals, showing a significant decline in subsequent weeks. This result correlates with the critical development of the thoracic region during early growth phases, which supports respiratory and cardiovascular efficiency (Oluyemi and Roberts, 2000).

Body length was significantly higher during weeks 10–12 (0.18 ± 0.01) and week 14–16 (0.18 ± 0.01) compared to Weeks 12–14 (0.14 ± 0.04). The consistent gains in body length during weeks 10–12 and weeks 14–16 may be attributed to increased protein utilization during periods of favourable environmental conditions, as suggested by the findings of Akinola and Okonkwo (2020).

The growth of both forelimbs and hind limbs followed a similar pattern, with significant increases during Week 10–12 and Week 14–16. Forelimb length increased from 0.06 ± 0 during Week 8–10 to 0.08 ± 0.01 during Week 14–16, while hind limb length peaked at 0.12 ± 0 during Week 10–12. This growth reflects the structural development necessary for mobility and weight support, aligning with the findings of Adebayo et al. (2021).

Tail length showed no significant changes between Week 8–10 and Week 10–12 (0.05 ± 0), but it declined significantly during Week 12–14 and Week 14–16 (0.04 ± 0.01 and 0.04 ± 0, respectively). This suggests that tail growth is not a priority during this developmental phase, as other body parts require more resources for growth. Parameters such as body weight, heart girth, and limb lengths showed substantial increases during Weeks 10–12, aligning with rapid growth phases and efficient feed conversion. These findings underscore the importance of optimal management practices during critical growth phases to enhance productivity.

Mongrel rabbits recoded positive and strong association between body weight and linear body measurements all through the period of this study (Tables 3 -5). Ologose *et al.* (2017), Obasi *et al*. (2019) and Sam *et al.* (2020) all recorded positive association between body weight (BW) and linear body measurement (LBM). The highest phenotypic correlation between body weight and linear body measurements at week 8 was obtained between body weight (BW) and hearth girth (HG- 0.752) followed by body weight and body length (BL- 0.664). Ologose *et al.* (2017) and Sam *et al.* (2020) observed that hearth girth and body length had the highest association with body weight at week 8. The strong association recorded between BW and (HG and BL) indicate that HG and BL can be used to predict BW at 8 week of age and also selected for improvement of growth traits. Phenotypic correlation amongst LBM were all positive at week 8 ranging from very high to low. This implies that all the linear parameters had the same direction of growth though at different rate. The result in this study agrees with that of, Ologose *et al.* (2017), Obasi *et al.* (2019) and Sam *et al.* (2020). The strongest correlation amongst LBM (0.607) was obtained between heart girth and ear length this implies that the selection of one would result in great benefit to

Table 3. Phenotypic correlation of body weight and linear body measurement at week 8 (above diagonal) and week 10 (below diagonal)

	BW	EL	HG	BL	FL	HL	TL
BW		0.637**	0.752**	0.664**	0.577**	0.542**	0.554**
EL	0.444**		0.607**	0.509**	0.457**	0.254	0.266*
HG	0.602**	0.443**		0.573**	0.520**	0.489**	0.393**
BL	0.642**	0.500**	0.629**		0.520**	0.501**	0.404**
FL	0.513**	0.514**	0.513**	0.544**		0.377**	0.270*
HL	0.672**	0.374**	0.477**	0.582**	0.458**		0.459**
TL	0.587**	0.260*	0.356**	0.432**	0.416**	0.516**	

*BW = body weight, EL = ear length, HG = hearth girth, BL = body length, FL = fore limb, HL = hind limb, TL = tail length ** = highly significant P < 0.01 * = significant P < 0.05*

Table 4. Phenotypic correlation of body weight and linear body measurement at week 12 (above diagonal) and week 14 (below diagonal)

	BW	EL	HG	BL	FL	HL	TL
BW		0.440**	0.513**	0.650**	0.634**	0.559**	0.571**
EL	0.500**		0.331**	0.579**	0.350**	0.350**	0.286*
HG	0.353**	0.318*		0.544**	0.290*	0.405**	0.298*
BL	0.667**	0.608**	0.587**		0.559**	0.539**	0.481**
FL	0.499**	0.223	0.364**	0.519**		0.501**	0.504**
HL	0.556**	0.438**	0.313*	0.544**	0.536**		0.521**
TL	0.529**	0.540**	0.169	0.536**	0.341**	0.532**	

*BW = body weight, EL = ear length, HG = hearth girth, BL = body length, FL = fore limb, HL = hind limb, TL = tail length ** = highly significant P < 0.01 * = significant P < 0.05*

Table 5. Phenotypic correlation of body weight and linear body measurement at week 16

	BW	EL	HG	BL	FL	HL	TL
BW		0.496**	0.236	0.681**	0.679**	0.618**	0.398**
EL			0.182	0.622**	0.418**	0.580**	0.454**
HG				0.459**	0.257*	0.184	-0.005
BL					0.709**	0.717**	0.422**
FL						0.648**	0.463**
HL							0.387**
TL							

*BW = body weight, EL = ear length, HG = hearth girth, BL = body length, FL = fore limb, HL = hind limb, TL = tail length ** = highly significant P < 0.01 * = significant P < 0.05*

the other. While ear length and hind limb had the least correlation, this implies that the selection of one would have the least benefit on the other. Ologose et al. (2017) and Sam et al. (2020) had high correlation between hearth girth and other morphometric traits implying that an improvement on hearth girth will result in corresponding improvement of other LBM.

At week 10 phenotypic correlation between body weight and linear body measurement observed, were all positive and highly significant (p<0.01). Sam *et al.* (2020) also recorded positive correlation between BW Band LBM at week 10. The highest correlation in this study was obtained between body weight and hind limb (0.672) followed by body weight and body length (0.602) while the least correlation (0.444) was with ear length. LBM all expressed positive correlations, the strongest association was between body length and hearth girth (0.629) while the least was between ear length and tail length (0.260). Ayo-Ajasa *et al.* (2018) reported body length and hearth girth to have high correlation between each other and can be selected for improvement.

At week 12, body weight had positive and significant correlation (p<0.01) with all LBM studied. Obasi *et al.* (2019), equally obtained positive correlation at week 12 of their study. The highest correlation was with body length (0.650) while the least was with ear length (0.440). This implies that body length is the most suitable for selection at week 12. LBM all had positive correlation the strongest was between body length and ear length while the weakest was between ear length and tail length.

Phenotypic correlation between BW and LBM at week 14 was positive and highly significant (p<0.01). Body length had the strongest association while heart girth had the weakest. Correlation on LBMs were all positive. Body length and ear length had the strongest association while hearth girth and tail length had the weakest.

There were positive correlations between body weight and amongst linear body measurements at week 16 expect for hearth girth and tail length which was negative. A negative correlation signifies that the selection of one for improvement would result in the reduction of the other. Obasi *et al*. (2019) and Sam *et al*. (2020) reported negative correlations amongst some morphometric traits. The best correlation between BW and LBM was BL while amongst LBM was between BL and HL, implying that body length (BL) if selected for improvement will positively affect all growth traits at week 16.

Table 6. Simple and Multiple Regression models for predicting Body Weight of Mongrels Rabbits for week 8, 10, 12, 14 and 16

Simple Prediction equation	R^2 (%)	SE	Sig	Multiple prediction equation	R^2 (%)	SE	Sig
BW = -469.65 + 57.97 HG	57	49.75	**	BW = -953.22 + 30.18 HG + 12.09 BL+ 42.01 TL + 35.84 EL	72	40.80	**
BW = -595.50 + 76.66 HL	45	63.41	**	BW = -967.23 + 42.54 HL + 27.59 HG + 59.21 TL	61	54.41	**
BW = -777.40+ 46.71 BL	42	77.43	**	BW = -1168.76 + 17.43 BL + 46.57 FL + 51.83 TL + 20.97 HG	60	65.97	**
BW = -1026.54 + 56.62 BL	45	89.13	**	BW = -1180.62+ 43.94 BL + 31.56 HL	50	85.50	**
BW = - 579.67 + 47.13 BL	46	93.58	**	BW = - 800.63 + 27.77 BL + 67.39 FL	54	87.35	**

*BW = body weight, EL = ear length, HG = hearth girth, BL = body length, FL = fore limb, HL = hind limb, TL = tail length, ** = highly significant P < 0.01 * = significant P < 0.05*

It is observed that correlation coefficient in all ages between BW and LBMs were positive, this means that as the LBMs or BW is increasing, a corresponding increase is expressed in the other. This mean that as any one linear body measurement or body weight is increasing, a corresponding increase is expressed in the other. The result Implies that, the improvement of body weight would result in a corresponding improvement of all the linear body measurements. The high and positive phenotypic correlations observed among the linear body measurements indicate high genetic variation, which supports high selection response. Implying that, any of the linear body parameters can be selected for improvement of body weight and that these correlated traits could jointly be selected, such that an improvement in one linear body measurement proportionately leads to simultaneous improvement in the other. This shows that growth in mongrel rabbit is asymmetrical with other parts. It is also indicator that as the rabbit grows, all the other parts are growing concurrently.

Table 6 presents the simple and multiple regression models used to predict the body weight (BW) of mongrel rabbits at weeks 8, 10, 12, 14, and 16. The models incorporate various linear body measurements, including heart girth (HG), body length (BL), hind limb (HL), forelimb (FL), tail length (TL), and ear length (EL). The performance of each model is evaluated using the coefficient of determination (R^2), standard error (S.E.), and statistical significance.

Prediction was possible since there were high and positive correlations between body weight and LBMs. This agrees with Sam *et al*. (2020) who reported that linear body measurements with high and positive correlation with body weight of rabbits can be used in body weight prediction which is essential in animal improvement. At week 8, heart girth (HG) was the best linear parameter used for prediction, it had the highest correlation with body weight and can therefore be selected for genetic improvement. Ologose *et al.* (2017) also observed (HG) to be the most preferred single predictor at week 8. The highest Coefficient of determination (R^2) 57% and 72% in the simple and multiple regression models respectively. This implies that prediction was most reliable at this week. At week 10, Hind limb (HL) was the best linear parameter used with (R^2) 45%. From week 12 to week 16 of this study, Body length (BL) was the best linear parameter for prediction, this implies that BL should be used for weight prediction in older mongrel rabbits. Higher R^2 values were obtained in the multiple regression equations where more linear parameters were used. Indicating that, multiple regression model should be more reliable. Udoh and Udofot (2016) also reported increased reliability of prediction model when more linear parameters are used for predictions.

4. CONCLUSION

This study highlights the significant potential of mongrel rabbits as a viable livestock species to combat food insecurity and address the persistent insufficiency of animal protein in Nigeria. The growth performance and linear body measurements of mongrel rabbits demonstrated progressive increases with age, underscoring their adaptability and potential for enhanced meat production in tropical environments. Strong phenotypic correlations observed between body weight and linear body measurements suggest that traits such as body length and heart girth are reliable predictors of body weight, making them valuable selection criteria for genetic improvement programs.

The findings revealed that mongrel rabbits exhibit a robust capacity for growth and adaptation, attributable to their genetic diversity and hybrid vigour. The observed trends in body conformation traits and their correlation with growth parameters further provide a foundation for strategic breeding programs aimed at improving productivity.

Furthermore, the study underscores the need for targeted management practices during critical growth phases to maximize productivity and improve the economic viability of rabbit farming. Future research should explore the genetic basis of growth traits and environmental adaptability in mongrel rabbits. Such studies would offer deeper insights into their potential for selective breeding and broader adoption in livestock production systems.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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