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Phenotypic correlations between body weight and morphometric traits in rabbits

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***Target audience:** Animal breeders, Producers, Farmers*

Abstract

This study aimed at determining the relationship between body weight and morphometric traits in rabbits. A total of 93 kittens generated from crosses of New Zealand White (NZW) x NZW, Chinchilla (CHA) x CHA, NZW x CHA and CHA x NZW genotypes of rabbits in a nested classification of a Completely Randomized Design were used for this study. Data on body weight (BW) and linear body measurements namely, body length (BL), ear length (EL), heart girth (HG), head- to- shoulder (HS), length of hind limb (LHB), length of forelimb (LFB), tail length (TL) and thigh girth (TG) in weeks 4, 8, and 12 were taken. The simple correlation procedure was used to establish the strength of relationship between growth traits. It was observed that in all the phenotypic correlations of the four (4) genotypes studied in week 4, the correlations were highly significant (P<0.01) and positive (0.70- 0.98), with the exception of CHA x NZW in which there were very low, negative and non-significant (P>0.05) correlation values (-0.11- 0.15), which implies weak association between morphometric traits and body weight. The phenotypic correlations observed in the four (4) genotypes in week 8 were highly significant and positive (0.70- 0.97), with the exception of those of NZW x NZW which had negative correlations between some of the growth traits (-0.01- -0.33), and CHA x NZW which had lower values between some of the growth traits (-0.04- 0.35). The phenotypic correlations observed in the four (4) genotypes in week 12 were non-significant (P>0.05) and low (0.02- 0.39), with the exception of NZW x CHA which had positive and very high significant values (0.70- 0.92), which implies a very strong association between morphometric traits and body weight in this genotype. It is therefore concluded that the NZW x CHA rabbits should be used for growth purposes rather than the other genotypes used for this study.

***Keywords:** Rabbit genotypes, body weight, morphometric traits, phenotypic correlation*

Description of Problem

To maximize food production and meet protein requirements in Nigeria, viable options need to be explored. Among such alternatives is the use of livestock species that are yet to play a major role in animal production in Nigeria. Fast-growing livestock such as rabbits possess a number of features that might be of advantage in the small holder subsistence-type integrated farming in developing countries. Rabbit is a micro livestock producing about 47kg of meat per doe per year, which is enough to solely meet the animal protein requirement of a medium sized family under small scale rural farming systems (1, 2). Besides, rabbit meat is rich in vitamin B and extremely low in cholesterol and sodium levels (3, 4). Starting a rabbit project requires minimal initial capital outlay. Domestic rabbits are raised in the tropics where they serve as a cheap source of meat for reasons of economy of feeding, high fecundity and prolificacy. The relationship between live body weight and body dimensions is very useful in the

prediction of live body weight of animals (5). The final body weight of animals is a reflection of the sum total of the weight of all its component parts (6). This means that a change in any one of the component parts could result positively or negatively on the final body weight depending on the direction of the change. Data obtained from such relationships are very useful to breeders in selecting animals destined for use as breeding stock (7).

The simple linear body measurements that can reliably predict body weight without necessitating animal slaughter will be particularly desirable (8). Rabbit producers and breeders are interested in the relationship that exists between body weight and linear traits because this information would tell something about rabbit feed efficiency and production performance (9). (10), (11) and (12) in their different studies on rabbit growth traits found that the rabbit has a progressive growth rate. Positive correlation coefficients between body weight and linear body measurements were reported (9) in all the ages of rabbits studied. Similarly, (13) observed high phenotypic correlations between body weight and linear body measurements in three month old rabbits.

The relationship between linear body measurements and body weight showed that growth in rabbit is asymmetrical with other body parts (9). (14) and (15) also found positive and highly significant phenotypic correlations between body weight and linear body parameters, and that all linear body measurements are good determinants of body weight. According to (16), positive relationships between the traits studied were as a result of pleiotropic effects of gene and linkage effects which operate on these traits. The author further stated that phenotypic selection for one trait will consequently result in improvement of the other.

To help breeders in selection and improvement of traits in rabbits, the objective of this study is to determine the relationship between body weight and morphometric traits in rabbits, namely body length, ear length, hearth girth, head-to-shoulder, length of hindlimb, length of forelimb, tail length, and thigh girth.

Materials and Methods

Research site

This experiment was carried out at the Rabbitary Unit, Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike, Abia State. The farm is located at latitude 05^0 29^1 North and longitude 07^0 32^1 East. The farm lies in the altitude of 122m and within the rainforest zone of south-east Nigeria, which has bimodal rainfall pattern and total annual rainfall of 2177mm, maximum ambient temperature range of 22 to 36^0C during the hot dry season of the year (November – March) and minimum ambient temperature range of 20^0C-26^0C during the cold rainy season (April-October). The relative humidity ranges from 50-90% and is located in warm humid tropics (17).

Experimental animals and their management

Ninety-three (93) kittens produced from crosses comprising of NZW x NZW, CHA x CHA, NZW x CHA and CHA x NZW (Table 1) were used for this study. The animals were housed in hutches, allowed to mate naturally and kindle. Feed (concentrate and forages-*Panicum maximum* and *Centrosema pubescens*) and water were given to the animals *ad libitum*. The diet fed to the animals consisted of 18% CP, 2600 Kcal/kgME, and 8% CF as analyzed. Routine management operations were carried out on a daily basis. The animals were given Ivomec injections against endo- and ecto- parasites.

Table 1: Mating scheme for the production of offspring

Mating Type	Number of Sires	Number of Dams	Number of Progeny
NZW X NZW	3	6	25
NZW X CHA	3	6	20
CHA X CHA	3	7	18
CHA X NZW	3	9	30

Data Collection

The following data were collected

Body weight (BW): The body weight was taken using a sensitive scale (0.01g) and a top loading Hana power 5 kg scale with sensitivity of 25 g.

Ear length (EL): Length from the base to the tip of the ear (cm).

Body length (BL): Length from the middle of the head to the base of the tail (cm).

Heart girth (HG): The circumference of the chest region (cm).

Thigh girth (TG): The circumference of the thigh region (cm).

Length of forelimb: Length from the base of the ulna bone to the tip of the feet (cm).

Length of hind limb: Length from the base of the pelvic bone to the tip of the feet (cm).

Head-to-shoulder (HS): Length from the head to the shoulder (cm).

Tail length (TL): Length from the base to the tip of the tail (cm).

The morphometric traits were measured using a measuring tape graduated in centimeters, and the phenotypic correlations were determined at weeks 4, 8 and 12.

Experimental design and statistical analysis

The experiment is a nested classification of a Completely Randomized Design with the offspring's morphometric traits and body weight being the main treatment effect measured. The simple correlation procedure of (18) was used to establish the strength of relationship between the morphometric traits and the body weight, using the expression,

$$r = \frac{\Sigma X_i Y_i}{\sqrt{\Sigma X^2{}_i \; \Sigma Y^2{}_i}}$$

Where,

r = Pearson's correlation

X_i = the first random variable of the i^{th} morphometric trait or body weight

Y_i = the second random variable of the i^{th} morphometric trait or body weight

Results and Discussion

Phenotypic correlation coefficients between body weight and morphometric traits in different rabbit genotypes at different ages

The phenotypic correlation coefficients of growth traits in NZW x NZW rabbit genotype in week 4 as presented in Table 2 (upper diagonal) showed all the correlations to be significant and positive ($P<0.05$, $P<0.01$), with the exception of those between BW and LHB; BL and TL; HG and HS, LHB and TL; HS and TG; LHB and TG; LFB and TL, TG; TL and TG. These results agree with the findings of (9) who reported a positive correlation coefficient in all the ages of rabbits studied. The positive and significant phenotypic relationships between morphometric traits and body weight indicate that an improvement in one trait could lead to a concomitant improvement in the other, barring environmental influences.

Table 2 (lower diagonal) shows the phenotypic correlation coefficient of growth traits in NZW x NZW rabbit genotype in week 8. There were positive and significant ($P<0.05$) phenotypic relationships among the morphometric traits measured, apart from the relationship between BW and HG, BL and LHB, BL and LFB, EL and LHB, LFB, TL, and TG; HG and HS, LHB, LFB, TL, TG, and

HS. The positive and significant phenotypic correlation results are also in agreement with the results of (10), (11) and (12).

Table 2: Phenotypic correlation coefficients among morphometric traits in NZW x NZW genotype at 4 weeks of age (upper diagonal) and at 8 weeks of age (lower diagonal)

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW	1	0.94**	0.68**	0.93**	0.50*	0.28	0.63**	0.52*	0.91**
BL	0.85**	1	0.67**	0.91**	0.60**	0.43*	0.74**	0.35	0.86**
EL	0.41*	0.74**	1	0.59**	0.92**	0.68**	0.57**	0.81**	0.49*
HG	0.34	0.58**	0.74**	1	0.40	0.13	0.45*	0.29	0.93**
HS	0.90**	0.81**	0.43	0.36	1	0.81**	0.64**	0.65**	0.32
LHB	0.66**	0.31	-0.21	-0.33	0.68**	1	0.75**	0.50*	-0.01
LFB	0.66**	0.34	-0.15	-0.28	0.66**	0.91**	1	0.41	0.33
TL	0.81**	0.75**	0.26	0.31	0.82**	0.58**	0.57**	1	0.27
TG	0.79**	0.65**	0.27	-0.01	0.78**	0.71**	0.69**	0.66**	1

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
NZW – New Zealand White, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

Table 3 (upper diagonal) shows the phenotypic correlation coefficients of growth traits in NZW x CHA rabbit genotype in week 4. There were positive and significant (P<0.01) phenotypic relationships between the following: BW and BL, EL, HG, HS, TL, and TG; BL and EL, HG, HS, and TL; EL and HG, HS and TL; HG and HS, TL; HS and TL, LHB and LFB. The rest were non-significant and negative. The positive phenotypic correlation results agree with (9), which is an indication that these correlated traits could be jointly selected. Phenotypic correlation coefficients of growth traits in NZW x CHA rabbit genotype in week 8 are shown in Table 3 (lower diagonal). There were highly positive and significant (P<0.01) phenotypic relationships in all the morphometric traits with the exception of the relationship existing between HG and all the other morphometric traits. This result agrees with those of (9) and (10) who reported positive correlations in the body weight and morphometric traits of rabbits studied in week 8. This implies that an improvement in one morphometric trait could lead to a simultaneous improvement in the other trait correlated with it.

Table 3: Phenotypic correlation coefficients among morphometric traits in NZW x CHA genotype at 4 weeks of age (upper diagonal) and at 8 weeks of age (lower diagonal)

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW	1	0.74**	0.53*	0.70**	0.65**	0.11	-0.06	0.57**	0.47*
BL	0.94**	1	0.70**	0.68**	0.45*	0.32	-0.25	0.46*	0.40
EL	0.88**	0.83**	1	0.77**	0.57**	-0.12	-0.07	0.77**	0.20
HG	0.36	0.28	0.31	1	0.83**	-0.12	-0.36	0.82**	0.22
HS	0.90**	0.80**	0.90**	0.20	1	-0.11	-0.50*	0.88**	0.12
LHB	0.72**	0.57**	0.83**	0.24	0.87**	1	0.67**	-0.32	0.28
LFB	0.84**	0.74**	0.82**	0.19	0.87**	0.77**	1	-0.52*	0.32
TL	0.70**	0.58**	0.85**	0.27	0.83**	0.84**	0.74**	1	0.19
TG	0.87**	0.87**	0.73**	0.27	0.71**	0.43	0.76**	0.47*	1

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
NZW – New Zealand White, CHA – Chinchilla, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

Phenotypic correlation coefficients of growth traits in CHA x NZW rabbit genotype in week 4 are presented in Table 4 (upper diagonal). Positive and significant (P<0.01) phenotypic relationships exist between the following: BW and BL, EL, HG and HS; BL and EL, HG, HS, and TL; EL and HG, HS and TL; HG and HS, LFB and TL, HS and TL, LHB and LFB. Negative and significant (P<0.01) phenotypic relationships exist between the following: BL and LHB, HG and LHB, HS and LHB, LHB and TL. The other correlation coefficients were not significant and were either positive or negative. The negative and significant relationship observed is an indication that an improvement in one trait can result in improvement in another if a reduction of the second trait is desired (19). The phenotypic correlation coefficients of growth traits in CHA x NZW rabbit genotype in week 8 are shown in Table 4 (lower diagonal). The positive and significant (P<0.01) phenotypic relationships are for the following pairs of traits: BW and BL, EL, HG, HS, LFB and TL; BL and EL, HG, HS, LFB and TL; EL and HG, HS, and TL; HG and HS, TL; HS and TL; LHB and LFB, TL and TG; LFB and TL, TG. The rest of the relationships are non-significant. Positive and significant phenotypic correlation indicates that an improvement in one trait could lead to a concomitant improvement in the other. The negative and significant phenotypic correlation indicates that an improvement in one trait could lead to a reduction in the other.

Table 4: Phenotypic correlation coefficients among morphometric traits in CHA x NZW genotype at 4 weeks of age (upper diagonal) and at 8 weeks of age (lower diagonal)

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW	1	0.39*	0.64**	0.69**	0.47**	-0.27	0.20	0.79	0.30
BL	0.80**	1	0.66**	0.68**	0.37*	-0.41*	0.15	0.64**	-0.24
EL	0.49**	0.56**	1	0.67**	0.55**	-0.25	0.35	0.71**	-0.11
HG	0.81**	0.90**	0.64**	1	0.41*	-0.36*	0.38*	0.79**	0.30
HS	0.67**	0.63**	0.73**	0.75**	1	-0.46*	-0.24	0.52**	0.04
LHB	0.35	0.04	0.22	-0.04	0.35	1	0.39*	-0.43*	0.18
LFB	0.39*	0.40*	0.19	0.21	0.30	0.57**	1	0.28	-0.03
TL	0.64**	0.67**	0.56**	0.66**	0.81**	0.42*	0.52**	1	-0.05
TG	0.24	0.07	-0.05	-0.18	-0.04	0.68**	0.39*	0.17	1

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level

NZW – New Zealand White, CHA – Chinchilla, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

The phenotypic correlation coefficient of growth traits in CHA x CHA rabbit genotype in week 4 are presented in Table 5 (upper diagonal). There were highly (above 0.60) positive and significant (P<0.01) phenotypic relationships for pairs of all the morphometric traits measured with the exception of the relationship between HS and all other linear parameters. The positive and highly significant correlation results obtained above are in agreement with the findings of (9), who found strong and positive phenotypic correlation between the morphometric traits measured, which is an indication that morphometric traits could be used to predict body weight with reasonable accuracy (10). Phenotypic correlation coefficients of growth traits in CHA x CHA rabbit genotype in week 8 are

shown in Table 5 (lower diagonal). There were highly (above 0.60) positive significant (P<0.01) phenotypic relationship in all the morphometric traits measured, with the exception of the relationship between HS and TG. These results agree with the findings of (9) who reported a positive correlation coefficient between BW and EL, HS, LL, HG, BL and TL in 8 weeks Chinchilla rabbits. High phenotypic correlations between studied morphometric traits in this rabbit genotype at week 8 agree with those of (14) and (15).

Table 5: Phenotypic correlation coefficients among morphometric traits in CHA x CHA genotype at 4 weeks of age (upper diagonal) and at 8 weeks of age (lower diagonal)

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW	1	0.98**	0.90**	0.98**	0.22	0.76**	0.65**	0.95**	0.94**
BL	0.97**	1	0.88**	0.96**	0.30	0.71**	0.63**	0.93**	0.94**
EL	0.94**	0.94**	1	0.94**	0.11	0.77**	0.77**	0.91**	0.91**
HG	0.97**	0.99**	0.95**	1	0.17	0.78**	0.68**	0.96**	0.95**
HS	0.76**	0.88**	0.80**	0.82**	1	-0.38	-0.36	0.26	0.16
LHB	0.80**	0.72**	0.81**	0.76**	0.42	1	0.92**	0.67**	0.77**
LFB	0.87**	0.85**	0.87**	0.86**	0.67**	0.92**	1	0.59**	0.70**
TL	0.95**	0.99**	0.94**	0.99**	0.89**	0.68**	0.83**	1	0.89**
TG	0.73**	0.64*	0.74**	0.73**	0.25	0.85**	0.72**	0.62*	1

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
NZW – New Zealand White, CHA – Chinchilla, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hind limb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

Phenotypic correlation coefficients of growth traits in NZW x NZW rabbit genotype in week 12 are shown in Table 6. All the correlations between body weight and morphometric traits are non-significant (P>0.05) with the exception of the relationship between BW and BL, HS; BL and EL, HS and TL; EL and HS, LFB and TL; HG and HS, LHB and LFB; HS and TL; LHB and LFB, TG; LFB and TG; and these relationships are in the positive direction. The significant correlations in this week were high (above 0.50) and are in consonance with the findings of (13) who found a high phenotypic correlation between morphometric traits of rabbits at their twelfth week.

Table 6: Phenotypic correlation coefficients among morphometric traits in NZW x NZW in week 12

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW									
BL	0.49*								
EL	0.24	0.73**							
HG	0.39	0.29	0.41						
HS	0.51*	0.75**	0.67**	0.58**					
LHB	0.42	0.32	0.30	0.51*	0.26				
LFB	0.16	0.38	0.51*	0.56**	0.26	0.74**			
TL	0.26	0.76**	0.68**	0.25	0.71**	0.23	0.31		
TG	0.19	0.02	0.13	0.04	-0.29	0.60**	0.51*	-0.15	

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
NZW – New Zealand White, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

Table 7 shows the phenotypic correlation coefficients of growth traits in NZW x CHA rabbit genotype in week 12. The correlation coefficient values were all positive and highly significant (P<0.01), except the relationship between BW and TL which was non-significant but moderate. The results in this rabbit genotype agree with the results of (9), (19) and (20) who found high and positive phenotypic correlations between the morphometric traits measured in the different genotypes of rabbits used, which is also an indication that these correlated traits could be jointly selected.

Table 7: Phenotypic correlation coefficients among morphometric traits in NZW x CHA in week 12

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW									
BL	0.79**								
EL	0.70**	0.80**							
HG	0.79**	0.82**	0.87**						
HS	0.63*	0.76**	0.75**	0.86**					
LHB	0.88**	0.76**	0.65*	0.69**	0.62*				
LFB	0.68**	0.84**	0.86**	0.91**	0.90**	0.66*			
TL	0.46	0.75**	0.75**	0.76**	0.92**	0.55*	0.92**		
TG	0.76**	0.79**	0.94**	0.82**	0.63**	0.70**	0.77**	0.61*	

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
NZW – New Zealand White, CHA – Chinchilla, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

The phenotypic correlation coefficients of growth traits in CHA x NZW rabbit genotype in week 12 are shown in Table 8. The phenotypic correlation coefficients that were significant (P<0.01) were all positive; the other relationships were not significant and were either positive or negative. The negative relationship observed is an indication that an improvement in one trait can result in improvement in another if a reduction of the second trait is desired (19).

Table 8: Phenotypic correlation coefficients among morphometric traits in CHA x NZW in week 12

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW									
BL	0.10								
EL	0.47*	0.09							
HG	0.38*	0.15	0.43*						
HS	0.39*	-0.10	0.35	0.56**					
LHB	0.40*	-0.14	0.40*	0.11	0.34				
LFB	0.15	0.41*	0.37*	0.50**	-0.18	-0.02			
TL	0.34	0.39*	0.47*	0.70**	0.53**	0.38*	0.57**		
TG	0.17	0.30	-0.07	-0.06	0.24	0.32	-0.37*	-0.00	

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
NZW – New Zealand White, CHA – Chinchilla, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

The phenotypic correlation coefficients of growth traits in CHA x CHA rabbit genotype in week 12 are presented in Table 9. High and positive significant (P<0.01) phenotypic relationships were observed between the following: BW and BL, EL, HS, LHB and TG; BL and EL, HG, HS and TL; EL and HG, HS, LHB, TL and TG; HG and HS, TL; HS and LHB, TL; LHB and TG. The only significant (P<0.01) and negative phenotypic relationships were between BW and LFB, LHB and LFB, LFB and TG. The negative and significant relationship observed is an indication that an improvement in one trait can result in improvement in another if a reduction of the second trait is desired (19). The positive correlation coefficient values are indications that as one morphometric trait is increasing, a corresponding increase is expressed in the body weight. The positive and significant phenotypic relationship between morphometric traits and body weight also indicates that an improvement in one trait could lead to an improvement in the other, barring environmental influences.

Table 9: Phenotypic correlation coefficients among morphometric traits in CHA x CHA in week 12

	BW	BL	EL	HG	HS	LHB	LFB	TL	TG
BW									
BL	0.65*								
EL	0.83**	0.94**							
HG	0.43	0.89**	0.79**						
HS	0.74**	0.96**	0.94**	0.90**					
LHB	0.84**	0.54	0.63*	0.25	0.61*				
LFB	-0.79**	-0.39	-0.55	-0.11	-0.51	-0.85**			
TL	0.54	0.96**	0.87**	0.97**	0.96**	0.41	0.29		
TG	0.89**	0.48	0.67*	0.12	0.53	0.87**	-0.88**	0.30	

* - correlation significant at 0.05 probability level; ** - correlation significant at 0.01 probability level
CHA – Chinchilla, BW – Body Weight, BL – Body Length, EL – Ear Length, HG – Heart Girth, HS – Head to Shoulder, LHB – Length of Hindlimb, LFB - Length of Forelimb, TL – Tail Length, TG – Thigh Girth

Conclusion and Applications

1. There were high phenotypic correlation coefficients between body weights and morphometric traits in the rabbit genotypes used.
2. The NZW x CHA rabbits should be used for growth purposes rather than its reciprocal cross since it had the best performance in terms of the positive and significant phenotypic correlations between its morphometric traits when compared to the other genotypes.
3. Morphometric traits can be used as indicators of body weight.
4. Where environmental influence is not substantial, a breeder can make some selection decisions like growth performance, based on the phenotypic correlations.

References

1. Adedeji, I. A., Adejumo, I. O. and Obaniji, K. S. (2012). Information needs of farmers in rabbit production in Sagamu Local Government Area of Ogun State. *Continental Journal of Agricultural Economics* 6 (1): 23 – 27.
2. Hassan, W. A. and Owolabi, R. O. (1996). Production performances of domesticated rabbits in semi-arid zone of

Nigeria. Proceedings of the 6th World Rabbit Congress, Tonbuse, France 3: 359 – 363.

3. Jithendran, K. P. (2000). Nutritive value of rabbit meat. Envis Bulletin. *Himalayan Ecology and Development* 8 (1): 9-11.
4. Omole, A. J., Omueti, O. and Ogunleke, O. J. (2005). Performance characteristics of weaned rabbits fed graded levels of dry cassava peel fortified with soy corn residue based diet. *Journal of Farm Agriculture and Environment* 3: 36 – 38.
5. Egena, S.S.A., Akpa, G.N., Alemede, I.C. and Aremu, A. (2014). Genotype, Gestation length, Season, Parity and Sex effects on growth traits of two rabbits breeds and their crosses. *Biotechnology in Animal Husbandry* 30(4): 717- 729.
6. Ozoje, M.O. and Mgbere, O.O. (2002). Coat pigmentation effects in West African dwarf goats: live weights and body dimensions. *Nigerian Journal of Animal Production* 29:5-10.
7. Isaac, L.J., Udoh, U.H., Usoro, O.O., Ekanem, E. and William, M.E. (2011). Relationship between body weight and linear body measurements in different breeds of rabbits. In: Proceedings of 36th Annual Conference of the Nigerian Society of Animal Production. 13th – 16th march. University of Abuja, Abuja, Nigeria. Pp. 10-12.
8. Chineke, C.A. (2005). The relationship among body weights and linear dimensions in rabbit breed and crosses. *Journal of Animal and Veterinary Advances* 4(9): 775-784.
9. Okoro, V. M. O., Ezeokeke, C. T. and Chukwudum, U. E. O. (2010). Phenotypic correlation of body weight and linear body measurement in Chinchilla rabbits (*Oryctolagus cuniculus*). *Journal of Agriculture, Biotechnology Sustainable Development* 2: 27 – 29.
10. Akanno, E.C. and Ibe, S.N. (2006). Prediction of body weight of the domestic rabbits at different stages of growth using linear body measurements. *Nigerian Journal of Animal Production* 33(1): 3-8.
11. Abdullah, A.R., Sokunbo, O.A., Omisola, O.O., Adewumi, M.K. (2003). Interrelationships between body weight and body linear measurements in domestic rabbits (*Orictolaguscuniculus).* Proceedings of the 28th Annual conference of Nigeria Society for Animal Production. Pp. 133-136.
12. Akpan, U.O. (1988). Studies on the growth and reproduction in New Zealand White breed and Dutch breed rabbits. M.Sc, Animal Science Thesis, Ahmadu Bello University, Zaria.
13. Elamin K. M., Yousif, I. A., Ahmed, M. K. A., Mohammed, S. A. and Tameem-Eldar, A.A. (2012). Estimation of genetic, phenotypic and Environmental Parameters of morphometric traits in Sudanese Rabbits. *Asian Journal of Animal Sciences* 6: 174-181.
14. Janssens, S. and Vandepitte, W. (2004). Genetic parameters for body measurements and linear type traits in Belgian Bleu Maine, Suffolk and Texel sheep. *Small Ruminant Research* 54:13-24.
15. Oke, U.K., Ibe, S.N. and Ogbonna, E.O. (2004). Effect of genotype on growth traits of rabbits. *International Journal of Agriculture and Rural Development* 5: 61-68.
16. El-Labban, A.F.M. (1999). Comparative studies on phenotypic performance of body measurements and carcass characteristics in males of some local strains of Chickens. *Egyptian Poultry Science Journal* 19:419-434.
17. NRCRI (2017). Agro-Meteorologic Unit. National Root Crop Research Institute, Umudike, Abia State, Nigeria.

18. SAS (1999). *SAS Users Guide: Statistics released version 8.0*. Statistical Analysis System Institute. Inc., Cary. NC.
19. Akanno, E. C. and Ibe, S. N. (2005). Estimates of genetic parameters for growth traits of domestic rabbits in the humid tropics. *Livestock Research for Rural Development*., vol. 17, No.7. http://www.irrd.org/irrd17/7/akan17086.htm
20. Chineke, C.A. (2000).Characterization of physical body traits of domestic rabbit in humid tropics. Proceedings of the 25th Annual Conference of the Nigerian Society for Animal Production (NSAP*)*, Michael Okpara University of Agriculture, Umudike, Abia State, March 19-23, 25:237-239.