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Research Article

Effects of Repeatability and Heritability Growth Traits on Indigenous Guinea Pigs in Nigeria

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Abstract

This study examined the genetic parameters, specifically heritability and repeatability, of growth traits in indigenous guinea pigs in Nigeria. The research focused on estimating these parameters for live body weight at birth, as well as during pre- and post-weaning phases. A total of 197 growing indigenous guinea pigs, offspring of 6 sires and 18 dams, were selected and raised at the Babcock University Animal holding facilities in Ilisan Remo. Each guinea pig was housed in individual plastic cages with labels, with cage sizes adhering to RSPCA guidelines. Data on birth weight, and pre- and post-weaning weights were collected to evaluate descriptive statistics, repeatability, and heritability using the restricted maximum likelihood (REML) method with SAS software. The results showed a consistent increase in live body weight, with mean values ranging from 76.510g at birth to 83.728–241.679g during weeks 1-7 (pre-weaning) and 265.600–330.884g during weeks 8-13 (post-weaning) for females. Male guinea pigs exhibited similar trends. The study found low repeatability in females and low heritability in males during the fourth week of the pre-weaning phase and the thirteenth week of the post-weaning phase. However, birth weight showed a high repeatability estimate in females. The findings suggest that additional data collection and improvement of non-genetic factors are necessary to enhance the accuracy of repeatability and heritability estimates for growth traits in indigenous guinea pigs in Nigeria as they progress through breeding age. The study concludes that the low repeatability and heritability estimates indicate a need for further data collection and improvements in non-genetic factors influencing growth traits.

Keywords: *Guinea pig, Heritability, Live body weight, Repeatability and Sex dimorphism*

Introduction

Knowledge of genetic and phenotypic parameters is required for planning sufficient breeding programs in animal husbandry. Two of these parameters are heritability and repeatability. The first explains the extent to which observed differences between individuals are associated with additive genetic variance (the variance of breeding values). With knowledge of these parameters, animal geneticist can determine whether or not a particular trait can be improved by selection, by improvement of management practices or both. The second is defined as the correlation between measurements made on the same animal or plant over time or space (Yaskin, 2013).

Predicting the breeding value of an individual animal is very important in animal breeding. It enables the breeder to determine the transmitting ability of each animal for the desired economic traits. The use of lifetime average repeated observation of birth weight, weaning weight and post- weaning weight of growing guinea pigs can be obtained using estimates of repeatability and

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heritability to calculate adjusted averages appropriate for comparing individuals with different numbers of records (Hedrick, 2012). Wright, (2000) suggested that variation in growth and in fertility is partly controlled by genetics. However, the only known repeatability and heritability estimates for guineas pigs are those reported for phenotypic and genetic parameters for liter size by (Solarte, *et al* 2007). The objective of present investigation was therefore to estimate the repeatability and heritability of growth traits of indigenous guinea pig in Nigeria.
Nigeria is faced with the challenges of rapidly increasing animal protein supply to help feed the teaming population without depleting the natural resources base. Even with increased efforts to produce poultry and birds, the issue still exists. However, micro livestock such as guinea pigs can be raised in Nigeria to ameliorate this challenge by (Costa, *et al* 2016). Guinea pigs have been widely bred in Latin America and in some francophone countries in Africa (Dillard, *et al* 1972). This livestock can be reared in backyards, and even on commercial scale because of its ease of management, the relative cheapness of its feed (as they can feed on grasses as well as kitchen wastes) and it attainment of market size earlier than ruminant animals. However, there is a need to improve the productivity of this small herbivore through a more appropriate breeding program.
Estimating genetic parameters, repeatability and heritability is regarded as a means of addressing the concerted application of modern scientific methods to animal breeding by (Solarte, *et al* 2007). Over the year, selective breeding and crossing of local breeds (that yield the best quality and quantity of meat at superior feed efficiency) has produced unprecedented year on-year heritable growth in performance, transforming the economics of production, and yielding the present- day high performing and highly, efficient commercial micro-livestock (Hedrick, 2012).
There has been paucity of data on genetic parameters of Indigenous livestock resources especially guinea pig in Nigeria. There is a need therefore to develop a sustainable breeding program through the genetic evaluation and the estimation of genetic parameters of indigenous guinea pigs. As this will improve the quantity and quality of meat from guinea pigs to meet the protein requirement of the teaming population of Nigeria citizens.

Materials and Methods

Data for this study was collected from 197 growing guinea pigs, the progeny of 6 sires and 18 dams. All the paternal half-sibs were raised at Babcock University Animal holding facilities in Ilishan Remo, Ogun State. Foundation stocks were sourced from several unrelated local lines and were evaluated independently and later intercrossed. One sire and three dams were kept in a cage. Sires were removed from the cage when all females showed signs of pregnancy and, shortly after weaning, they were returned to their cages to allow mating immediately after farrowing. Dams and litters (pups) were kept in the same cage up to weaning (4 weeks). Thereafter, weaned animals were separated and caged by sex and age up to selection age (13 weeks).
Animals were fed, *ad libitum*, the standard diet (Pellet) and fresh *Tridax- procumben*. Plastic feeders were used for water and feed. Fresh wood shaving was used as bedding materials.
Fresh feed and water were given daily, while vitamin C was administered into their water twice a week for the period of theexperiment.
Data collection: At birth, all animals were identified by citric acid solution coloring at hind quarters. Birth weights within the first 24 hours of birth were recorded. Litter size at birth, litter size at weaning, weaning weight and animal weight at 13 weeks were also recorded.

The descriptive statistics of the data were computed using PROC MEANS of SAS (2015). Genetic Analysis: Estimation of Variance Components for the Determination of Repeatability and Heritability. The variance components that were used for the computation of repeatability and heritability were estimated using the method of paternal half-sib correlation analysis adapted for multiparous species, given by Becker (1975).

$$\gamma_{ij} = \quad \mu + \alpha_i + e_{ij} \qquad (1)$$

Where;
γ_{ij} = The litter size, birth weight and weaning weight of individual animal (growing guinea pig)
μ = The overall mean,
α_i= The effect of the i^{th} sire and

e_{ij}= The uncontrolled environmental and genetic deviations attributable to individuals within each sire groups. All effects are random, normal and independent with expectation equal to zero.

The variance components were obtained by the variance components procedure (PROC VARCOMP) of SAS (2015) using the restricted maximum likelihood (REML) method.

Repeatability: Repeatability coefficient was estimated using the following formulae [6].

$$R = \frac{б^2_W}{б^2_w + б^2_E} \quad (2)$$

Where: $$б_w^2 = \frac{MS_w - MS_E}{K} \quad (3)$$

R= Repeatability

MS_B= Mean square within individuals

MS_E = Mean square between individuals

K = Number of record per Animal

$б_w^2$= Variance component of the Animal = estimates all the genetic variance and the portion of the environmental variance peculiar to the individual Animal.

$б_w^2$ =Variance component (error) = the differences among measurements within the individual Animal.

The standard error (S.E.) of the estimation in this study is given by Becker (1975) expressed as:

$$\text{S.E. (R)} = \frac{\sqrt{2(1-R)^2[1+(K-1)R]^2}}{k(K-1)(n-1)} \quad (4)$$

Where: K = Number of record per animal R = Repeatability

N = Number of progeny

Heritability: Heritability (h^2) was calculated using the formulae below Becker (1975)

$$h^2s = \frac{4(\sigma^2 s)}{(\sigma^2 s+\sigma^2 W)} \quad (5)$$

Where;

h^2s = the paternal half- sibs estimate,

σ^2s = the sire components of variance,

σ^2w = the within sire components of variance (Error or residual variance component).

The standard error (SE) of heritability was calculated using the formulae of Young, *et al.*, (1978) assuming normality of intraclass correlation).

$$\mathbf{SE\ (h^2)} = \frac{\mathbf{4}\sqrt{\mathbf{2(n-1)(1-t)[1+(k-t)t]}}}{\mathbf{k(n-s)(s-1)}} \quad (6)$$

$$\mathbf{t} = \text{ intraclass correlation} = \frac{\sigma^2 s}{(\sigma^2 s+\sigma^2 w)} \quad (7)$$

k = average number of progeny per sire

n = total number of progenies

s = total number of sires

Results and Discussion

The body weight, linear body measurements and heat tolerance characteristics of piglets, growers and finishers are presented in the results revealed that finishers had significantly higher body weight, body length, Chest girth, Chest depth, withers height, rump height, ear length, snout length and tail length, followed by growers while the least values were recorded in piglets. These include descriptive statistics of live body weight of indigenous guinea pig at birth, descriptive statistics of live body weight at pre-weaning stage (1 – 7 weeks), and post-weaning stage (8 – 13 weeks), estimate of variance components, repeatability and heritability for live body weight at birth, pre-weaning stage (1 – 7 weeks), and post-weaning stage (8 – 13 weeks).

Live Body Weight of Indigenous Guinea Pigs

The descriptive statistics of live body weight of Indigenous guinea pigs for male and female equally varies individually at weekly, pre-weaning stage (1 – 7 weeks), and post-weaning (8 – 13 weeks) stages although the same value was recorded at birth weight as presented in Tables 1 and 2. This could be attributed to the genetic potential and the prevailing environmental factor influencing the trait and the age of the growing guinea pig, as age is major factor that determines to a great extent the growth and physiological development of the trait.

The identical numerical values of 76.51g, 5.26 for standard derivation, 0.375g for standard error, 5.259g and 6.874g for the coefficient of variation in males and females, respectively, were recorded in the descriptive statistics of the total mean birth weight. These indicate that no observable sex dimorphism had developed at this stage in Indigenous guinea pig, although these results are lower than the Nigerian indigenous Guinea pigs, hybrid and backcross Guinea pigs in literature. For example, Adeoye *et al.* (2012) reported 105g birth weight of progenies for pups produced by African Swine Farm recovered males and females. Ajayi and Akinokun (2013) reported a mean birth weight of 93g for Nigerian Indigenous Guinea pigs. Aladi *et al.* (2008) equally registered 80g body weight for Nigerian Indigenous Guinea pigs at birth. The findings of 92g, 93g and 92g respectively reported by Ilori (1974), Adeoye (2002) and Oluwole and Omitogun (2015) were similarly but greater than 76.51g from the work. These lower values obtained in this study could be traceable to genetic potential of the breed, management system and environmental temperature.

However, these lower values obtained in this study could be traceable to genetic potential of the breed, management system and environmental temperature. It is equally observed in Tables 1 and 2 that the same low standard error of 0.375g was recorded for both male and female. This estimate was lower than the 2.0g obtained for hybrid piglet in both dry and wet seasons; 3.0g and 4.0g registered for Nigerian Indigenous pigs for dry and wet season respectively and 17.0g and 4.0g were reported for backcross piglets for dry season and wet season respectively as reported by Oluwole and onitogun (2015). The differences are as a result of varying number of progenies employed for the experimentation (observation) as higher number of observation (N) statically leads to low values of standard error and vice versa. However, the low standard error obtained in this study compares favourably with their ports of Okeudo *et al.,* (2007): Okoro *et al.,* (2015); Oluwole *et al.,* (2014).

In the mean pre-weaning stage raised from week 1 – 7 weeks presented in Tables 1 and 2, the overall mean values of live body weight of 76.510 – 241.679g were recorded for both males and females. Whereas 147.93g was recorded for both the males and females at 4 weeks which was the principal focus under the pre-weaning stage in this study. These values are lower than the result reported in the literature. Okeudo *et al.,* (2007) reported 350g for the male and 370g for the female in rid of Nigerian Indigenous piglets and large white breed at 5 weeks of age for pre-weaning stage. Oluwole *et al.,* (2014) recorded 696 g for the male and 652g for the female in Nigerian indigenous pigs crossbred at 7 weeks of age. Adeoye *et al.*. (2012) obtained 694g for the female and 713g for the male employing ASF survivors' parents at the pre-weaning stage. Okoro *et al.* (2015) registered 534 g body weight at 4 weeks of age employing crossbred Nigerian Indigenous guinea pig at the pre-weaning stage. Ajayi, and Akinokun (2013) registered the body weight of 403-g for the pre-weaning stage using Nigerian indigenous male piglets. The observed differences between the native guinea pigs used in this study and the native crossbreds, native guinea pigs, and exotic breeds reported in literature could be explained by variations in the genetic potential of the breed, the management style, and the environmental temperature variations.

From Tables 1 and 2, it could be observed that the post-weaning stage ranges from the 8 – 13 weeks with corresponding overall mean values of 265.60g – 333.884g for the male and 265.60g – 333.986g for female. Whereas, 330.884g and 330.986 g were recorded for male and female respectively at the 13 weeks which is the anchored post-weaning period in this study. There is a depression in the body with of the guinea pigs between the 12 and 13 weeks as a result of the inception of the wet season. This is because during this season there is a reduction in the feed intake of the guinea pigs. These values are below the report registered under post-weaning stage for Nigerian indigenous Guinea pigs and their crossbreds. Adeola *et al.,* (2013) registered live body weight of 1250g for the Teaching and Research Farm (*T & R Farm), 1370g for Ogbooro farm, 1210g for Institute of Agricultural Research and Training, 1110g for Igbana Ado farm for both* indigenous and crossbred pigs under post-weaning stage; 1530g for crossbred pigs and 1240g for local pigs under post-weaning stage. Chiboka (1981) reported a lower value of 930g. Okeudo *et al.* (2007) obtained 710g and 690g for male Nigerian indigenous pigs, and their crossbred respectively at 15 weeks; Nigerian Indigenous guinea pigs weighing 780g for males and 780g for females, and their crossbred respectively at 15 weeks of age; 1040g and 1190 g for male Nigerian Indigenous guinea pigs and their crossbred respectively at 25 weeks of age; 913g and 1440g for female Nigeria Indigenous pigs and their crossbred respectively at 25 weeks of age.

In the same week of output during the dry season, Oluwole and Onitogun (2015) recorded 648g for the male and 687g for the female. Oluwole and Onitogun (2016) conducted a research in which she measured the live body weight of indigenous guinea pigs from Nigeria. The results showed that the male and female weighed 758g and 775g at 9 weeks of age, respectively; at 17 weeks, the male and female weighed 1283g and 1342g, and at 25 weeks, the male weighed 1510g and the female 1613g. The total means of native guinea pigs from Nigeria and their hybrids were also assessed by the researchers. The results showed that the hybrid and native Nigerian guinea pigs produced 83g and 767g at 9 weeks, 1473g and 1313g at 17 weeks, and 1510g and 1423g at 25 weeks, respectively.

Moreover, this study agrees with the findings of Holness (1991) that indigenous breeds are smaller with shorter legs than exotic or the crossbred counterparts. Smaller size may yield a greater ability to survive under the harsh conditions of low-input production by Oluwole and Onitogun (2016), especially in this climate change era which Africa and particularly sub-Sahara Africa are grossly vulnerable.

Repeatability Estimate of Live Body Weight of Indigenous Guinea Pigs: The genetic potential, additive genetic variance and presumed non-additive genetics plus permanent environmental variance as a proportion of phenotypic variance from birth weight to week 13 were indications of the variations in the repeatability estimate observed for live body weight employing dam in this study as presented in Table 3.

High repeatability estimates of 0.732 ± 0.000793 were recorded for live body weight at birth for female indigenous guinea pig in this study indicating higher role of additive genetic variance in the phenotypic expression compared to non-additive genetic together with permanent environmental variance as a proportion of phenotypic variance at birth. These high estimates are higher compared to the report in literature. Adeoye *et al.* (2003) obtained -0.025 ± 0.006 live body weight at birth for Nigerian Indigenous female guinea pigs employing the mixed procedure of statistical analytical system for a half-sib correlation analysis adopted to multifarious species. Ehiobu, and kyado (2000) reported 0.12 ± 0.008 live body weight at birth for female large white Hampshire and their crosses employing a one-way analysis of variance. Costa, *et al*,. (2016) obtained 0.1527 mean pups weight at birth using exotic breed employing a tool for the mixed model analysis of quantitative genetics by restricted maximum likelihood (REML). The discrepancies between the high estimate obtained in this study and the low estimates found in the literature could be attributed to the fact that the genetic potential of the live body weight of Indigenous guinea pig was well-expressed at birth as a result of the minimal impact of the environmental factor on the trait.

For the pre-weaning phase, an estimate of repeatability was recorded between 1 – 7 weeks of age but special emphasis was placed on 4 weeks of age to correspond with the estimation of genetic parameters as presented in Table 3. Under this phase, the maximum repeatability estimate of 0.5549±0.000645 was reported at 2 weeks of age whereas, the minimum repeatability estimate of 0.1063 ± 0.000262 which doubles as the focus phase in the pre-weaning stage according to the objective of this study was reported at 4 weeks of age. Generally, the repeatability estimate in the pre-weaning stage in this study ranged from 1 – 7 weeks revealed as 0.1063 – 0.5549. On the whole, these values are lower than the estimate obtained for live birth weight. This is because environmental factors may have affected the live body weight of the animals. Whereby causing the genetic potential of the trait to be suppressed.

However, the range of values obtained at this pre-weaning stage 0.1063 ± 0.000262 – 0.5549 ± 0.000645 falls within low to moderate repeatability estimates whereas the principal focus (4 week of age) showed low repeatability estimates of 0.1063 ± 0.000262. These low estimates obtained at 4 week of age are similar to the report found in the literature. Adeoye *et al.* (2003) reported 0.19 ± 0.07 repeatability estimate using Nigerian indigenous female. Costa, *et al*,. (2016) obtained 0.12 ± 0.08 repeatability estimates at 4 weeks of age employing mean female American breed and their crossbred. The low estimate of repeatability obtained in this study is however, higher than 0.0949 at 4 weeks of age registered in the state of Santa Catarina, Southern Brazil reported by Costa, *et al*,. (2016). These contrasting discrepancies may be driven by environmental influences such as climate, nutrition and management system.

From Table 3, the value obtained in the post-weaning stage week 8 – 13 and week 13 being the principal focus under this stage reported low repeatability estimates in the range of 0.0418 ± 0.000208 – 0.2267 ± 0.000367 where the anchored week under this stage (13 week) recorded 0.1670 ± 0.000315. These estimates compare favourably to 0.18 ± 0.006 repeatability estimates reported by Adeoye *et al*. (2003) over the period of 11 years (1977 – 1987) using Nigerian indigenous female pup guinea pigs.

The genetic potential for the weekly, pre-weaning and post-weaning stages of live body weights varied from one stage to another principally because of the variation of the genetic response and the inherent transmitting ability of parent traits from one generation to another as presented in Table 4. From Table 4, the heritability estimate of live body weight at birth reported low value. This result is different from the report found in the literature. Dallard, *et. al* (1972) reported low estimates of 0.15 ± 0.12, 0.51 ± 0.26 and 0.25 ± 0.11 for live body weight at birth in line 1, line 2 and pooled data using guinea pig employing mixed model least-square and maximum likelihood method. The pooled estimate for birth weight (0.25 ± 0.11) obtained by (1972) is probably more realistic compared to that of 0.58 obtained by Vaccaro, *et al*; (1968), since it is based on more records from the same population. Ajayi and Akinokun (2013) registered birth weight of 0.36 ± 0.09 of Nigerian Indigenous guinea pigs reared within 1977 – 1990. Akanno*, et al;* (2013) reported low heritability estimates of 0.10 ± 0.016, 0.18 ± 0.032 and 0.03 ± 0.017 for indigenous pigs, exotic breeds and maternal heritability respectively at birth weight.

Under the pre-weaning phase week 1 – 7, low, moderate and high estimates of heritability were registered as presented in Table 4.4. Among the estimates recorded for the pre-weaning stage, the principal focus week for this study (4 weeks of age) reported the lowest heritability estimate of 0.0639 ± 0.928 with a corresponding highest standard error, whereas, 3 week of age reported the highest heritability estimate of 0.9059 ± 0.123 with corresponding lowest standard error. Robust heritability estimates of 0.7558 ± and 0.9059 ± 0.123, reported at 1 and 3 weeks imply the higher role of additive genetic variance in the phenotypic expression of the trait compared to the influence of presumed non-additive genetic plus permanent environmental variance as a proportion of phenotypic variance thereby differing from the report in literature Ajayi, and Akinokun (2013).
While weeks 4, 5 and 7 experienced a decline in heritability estimate showing that the environmental factors posit great influence on the trait; the influence was intensified at week 2 which reported a low value. These estimate falls within the range of low, moderate and high reported found in literature. Ajayi, and Akinokun (2013) reported 0.37 ± 0.12 males using Nigerian indigenous guinea pigs for a period of fourteen years (1977 – 1990) in the pre-weaning stage. Ehiobu, (2000) reported higher estimate of 0.58 compared to Ajayi, and Akinokun (2013) but higher than 0.18 reported by Akanno, *et al*; (2013) 0.10 ± 0.03 recorded by Strang and King using exotic guinea pigs and 0.41 ± 0.15; 0.49 ± 0.13 heritability estimates in line 1 and line 3 guinea pig; but lower than 0.75 ± 0.31 heritability estimate in line 2 guinea pig registered by Dallard, *et al*; (1972) 0.18 ± 0.027, 0.24 ± 0.036, and 0.23 ± 0.014 for Indigenous guinea pigs, exotic guinea pigs and maternal heritability respectively reported by [30]; but lower than 0.75 ± 0.31 estimate in line 2 guinea pig registered by Dallard, *et al;* (1972).

In the post-weaning stage (week 8 – 12), heritability estimates registered low estimates except for week 13 which reported moderate estimate of 0.4365 ± 0.45. This report compares favourably with the results in the literature for Nigerian indigenous guinea pigs, crossbred and large white. Akanno, *et al*; (2013) reported 0.49 ± 0.199, 0.36 ± 0.038 and 0.32 ± 0.001 for indigenous guinea pigs, exotic guinea pigs, and maternal heritability. Dallard, *et al*; (1972) reported higher estimate of 0.50 ± 0.15, 0.49 ± 0.23 and 0.52 ± 0.13 for line 1, line 2 and pooled data of guinea piglets. Strang, and King(1970) reported 0.12 ± 0.04 for large white piglets at one year of production. From the result comparison in this section, it can be observed that slight differences in the heritability estimates among the Indigenous guinea pigs employed in this study, and various breeds of pig found locally in literature such as other Nigerian Indigenous piglets and large white counterpart found across the globe at birth weight, pre-weaning and post-weaning stages might have been as a result of discrepancies in breeds and environmental factors under which the pups were kept.

Conclusion

The results of this study revealed that as the age of the guinea pigs' increases, the live body weight at the pre-weaning (1-7 weeks) and post-weaning (8 – 13 weeks) phase's increases for both the male and female. High, moderate and low repeatability and heritability estimates at birth, pre-weaning (1-7 weeks) and post-weaning (8 – 13 weeks) phases of live body weight were obtained. However post-weaning phase are generally more repeatable and heritable for both dam and sire except heritability at birth weight and 2nd week of age for the sire that were inestimable in this study. However, the anchored week, 4th week of age for the pre-weaning phase and 13th week of age for the post-weaning phase had low repeatable and heritable characteristics. Thus, the influence of age and its contribution to the estimate of repeatability and heritability of indigenous guinea pig for dam and sire in this study is not appreciable, due to the considerably low estimates of repeatability and heritability obtained in the pre-weaning (4th week of age) and post-weaning (13th week of age) phases. Therefore, to obtain more realistic estimates of repeatability and heritability, improvement in the production environment, feeding and nutrition, collection of additional records and general improvement of the non-genetic factors influencing pre and post-weaning phases in this study, will improve the accuracy of predicting the inherent transmitting ability of the guinea pigs in the lowly repeatable and heritable pre-and post-weaning phases of live body weight trait. This will enable the producers to make early selections among guinea pigs since good pups will repeat and be more heritable in their performance in the pre-weaning phase.

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Table1: Descriptive Statistics of Live Body Weight of Female Growing Guinea Pigs

Variable	N	Mean	Std Dev	Std Error	Coefficient of Variation
BWT	197	76.510	5.259	0.375	6.874
WK1	196	83.677	8.197	0.585	9.796
WK2	196	106.468	14.349	1.025	13.477
WK3	196	121.998	14.492	1.035	11.879
WK4	196	147.927	14.418	1.030	9.747
WK5	196	178.714	19.969	1.426	11.174
WK6	196	208.924	21.209	1.515	10.152
WK7	196	241.679	21.706	1.550	8.981
WK8	195	265.600	24.448	1.751	9.205
WK9	195	296.432	33.227	2.379	11.209
WK10	195	313.142	19.706	1.411	6.293
WK11	195	326.553	14.762	1.057	4.521
WK12	195	333.336	37.386	2.677	11.216
WK13	195	330.986	10.599	0.759	3.202

Table 2: Descriptive Statistics of Live Body Weight of Male Growing Guinea Pig

Variable	N	Mean	Std Dev	Std Error	Coefficient of Variation
BWT	197	76.510	5.259	0.375	6.874
Wk1	196	83.728	8.149	0.582	9.733
Wk2	196	106.468	14.349	1.025	13.477
Wk3	196	121.487	16.217	1.158	13.348
Wk4	196	147.927	14.418	1.030	9.747
Wk5	196	178.714	19.969	1.426	11.174
Wk6	196	208.924	21.209	1.515	10.152
Wk7	196	241.679	21.706	1.550	8.981
Wk8	195	265.600	24.448	1.751	9.205
Wk9	195	297.458	27.271	1.953	9.168
Wk10	195	313.142	19.706	1.411	6.293
Wk11	195	326.451	14.763	1.057	4.522
Wk12	195	333.223	37.393	2.678	11.222
Wk13	195	330.884	10.617	0.760	3.209

Table 3: Variance component, Estimates, K-value and Repeatability estimates± standard error for Live Body Weight (g) of Dam Indigenous Guinea Pigs at various ages

Age	Variance Components	Estimates	%	K-value	[1]R±SE
BWT	Dam	20.72667	20.91	6	0.732330872±0.000793
	Error	7.57566	79.09		
Week 1	Dam	25.00856	6.445	6	0.376642654±0.000493
	Error	41.39008	93.55		
Week 2	Dam	117.6041	6.926	6	0.554929855±0.000645
	Error	94.32198	93.07		
Week 3	Dam	95.55324	1.950	6	0.355991986±0.000475
	Error	172.86078	98.05		
Week 4	Dam	22.23435	10.65	6	0.106326631±0.000262
	Error	186.8793	89.35		
Week 5	Dam	49.46623	10.85	6	0.123178144±0.000276
	Error	352.11662	89.16		
Week 6	Dam	233.4451	3.677	6	0.515326896±0.000611
	Error	219.55885	96.32		
Week 7	Dam	99.59351	6.445	6	0.211240576±0.000351
	Error	371.87609	93.55		
Week 8	Dam	128.6553	6.926	6	0.214091235±0.000356
	Error	472.28153	93.07		
Week 9	Dam	154.9947	1.950	6	0.207105378±0.000350
	Error	593.3911	98.05		
Week 10	Dam	68.40714	10.65	6	0.175163273±0.000322
	Error	322.12644	89.35		
Week 11	Dam	49.42502	10.85	6	0.226703085±0.000367
	Error	168.59151	89.16		
Week 12	Dam	58.47303	3.677	6	0.041764271±0.000208
	Error	1341.6	96.32		
Week 13	Dam	18.90833	3.677	6	0.167045844±0.000315
	Error	94.28413	96.32		

Where % represents the percentage contribution to total variance at varying age and [1]R±SE represents repeatability±standard error

Table 4: Variance component, Estimates, K-value and Heritability estimates± standard error for Live Body Weight (g) of Sire Indigenous Guinea Pigs at various ages

Age	Variance components	Estimates	%	K-value	[1]H±SE
BWT	Sire	20.07801	65.38	6	0.1000021±0.231
	Error	10.63205	34.62		
Week 1	Sire	13.12438	18.89	6	0.7556023±0.197
	Error	56.35333	81.11		
Week 2	Sire	91.95978	41.33	6	0.1100100±0.210
	Error	130.5308	58.67		
Week 3	Sire	49.67475	22.65	6	0.9059133±0.123
	Error	169.6608	77.35		
Week 4	Sire	3.32693	1.600	6	0.0638656±0.928
	Error	205.0438	98.40		
Week 5	Sire	20.76642	5.150	6	0.2061033±0.998
	Error	382.263	94.85		
Week 6	Sire	64.33837	13.93	6	0.5570257±0.300
	Error	397.6753	86.07		
Week 7	Sire	10.14713	2.150	6	0.0858577±1.010
	Error	462.5945	97.85		
Week 8	Sire	0.000000	0.000	6	0.000000±0.000
	Error	597.6849	100.0		
Week 9	Sire	81.94779	7.330	6	0.2933916±0.892
	Error	1035.300	92.67		
Week 10	Sire	27.92444	7.110	6	0.284265±0.830
	Error	365.0108	92.89		
Week 11	Sire	37.15602	16.66	6	0.6664929±0.230
	Error	185.8382	83.34		
Week 12	Sire	11.32994	0.810	6	0.0323798±0.491
	Error	1388.300	99.19		
Week 13	Sire	12.47406	10.91	6	0.4365179±0.450
	Error	101.8311	89.09		

Where % represents the percentage contribution to total variance at varying age and [1]H±SE represents Heritability±standard error