PREDICTING BODY WEIGHT OF RABBIT FROM LINEAR BODY MEASUREMENTS AT VARIOUS AGES BY GENETIC GROUP, PARITY AND SEX

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ABSTRACT

Individual body weight was predicted at various ages by genetic group, parity and sex using two strains of rabbits namely; New Zealand White (NZW), Chinchilla (CH) and their crosses. Data on individual body weight, nose to shoulder length, shoulder to tail length, heart girth, trunk length and length of ear of 130 rabbit kittens were collected on six genetic groups and used to predict body weight at pre-weaning (21 days), weaning (35 days) and post-weaning ages (49 days), respectively. Results revealed that body weight and linear body measurements had mostly significant ($p<0.05$ or $p<0.01$) association except for CH breed at 35 days post-partum ($p>0.05$). The value of the coefficient of determination ranged from 0.49 to 0.99 being maximal for CH x (CH x NZW) cross at 21 and 49 days post-partum and minimal for NZW x CH cross at 49 days post-partum. It was concluded that body weight could be predicted accurately based on the value of the coefficient of determination.

Key words: Body weight, Linear body measurements, Genetic group, Sex, Parity.

INTRODUCTION

Body conformation and size are important traits in animals used for meat production. This trait has been largely estimated quantitatively by the use of scale weight. The importance of body weight in the assessment of the economic value of farm animals cannot be over-emphasized. Weighing scales which are common in governmental farms and in the urban areas of most communities are a rarity in rural areas. Rural farmers use visual appraisal as a means of evaluating body weight of animals. This method is subjective, non scientific and can easily lead to errors. Developing an objective means of describing and evaluating body weight and conformation traits would be a long way in overcoming many of the problems associated with visual assessment.

Relating body weight to linear body measurements is one way of predicting body weight of rabbits. 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; Abdullahi *et al.,* 2003; Isaac *et al.,* 2011; Atansuyi *et al.,* 2011). 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.
The objective of this study was developing predictive equations that could be used in assessing the body weight of rabbits by genetic group, parity and sex from linear body measurement traits.

MATERIALS AND METHODS

Location of the study

The experiment was conducted at the Rabbitry section of the Teaching and Research Farm of the Department of Animal Production, Federal University of Technology, Minna, Niger State, Nigeria. Minna is located between latitude 9^0 37' north and longitude 6^0 32' east of the equator. The altitude is 853 feet above sea level. Annual precipitation averages 1312 mm with a mean temperature of between 19^0 C and 37^0 C. The mean relative humidity is between 21 – 73 % (Climatetemp, 2011). Minna falls within the southern guinea savannah zone of Nigeria.

Animals and experimental design

Two breeds of rabbits (New Zealand White and Chinchilla) were used in the study. The stock was sourced from the National Veterinary Research Institute (NVRI) Vom near Jos, Plateau State, Nigeria. The animals were housed in groups (i.e according to the strain) in well ventilated and shaded hutches. The hutches were raised on wooden legs about 60 cm above the ground. The rabbits were fed a 16 % CP; 2776 kcal/kg formulated concentrate diet supplemented with *Tridax procumbens* as well as legume hay supplement. Water was given *ad libitum* throughout the experimental period. Other routine management practices observed included cleaning of the hutches, administration of anti-stress as well as prophylactic treatment of Coccidiosis. All healthy does without noticeable defects were retained for breeding.

Six bucks (three each of New Zealand White and Chinchilla) and 18 does (nine each of New Zealand White and Chinchilla) were the initial stock used in the experiment. Mating commenced when the animals were between 4-5 months of age (*i.e* 120-150 days) and weighing between 1.45-1.50 Kg. The does were introduced to the bucks for mating and they were allowed to remain with the bucks until mating was assured. The does were monitored for pregnancy through palpation of the abdominal region. Plastic nesting boxes were provided at 24 days after fertile mating. The nesting boxes were provided early in order to facilitate acclimatization by the does. The mating scheme used and the number of kittens generated by genetic group is as shown in Table 1.

The parameters considered in this study were individual body weight (IBW), nose to shoulder length (NTS), shoulder to tail length (STL), heart girth (HG), trunk length (TL) and length of ear (LE). All linear measurements were carried out using flexible tape rule (cm) while body weight was measured using a sensitive scale in kg.

Table 1: Number of rabbits used in the experimental work and description of genetic group of sires and dams produced from them

Genetic group of rabbit*	N	Genetic group of sire	Genetic group of dam
NZW x NZW	17	NZW	NZW
CH x CH	19	CH	CH
NZW x CH	29	NZW	CH
CH x NZW	33	CH	NZW
NZW x (NZW x CH)	19	NZW	NZW x CH
CH x (CH x NZW))	13	CH	CH x NZW
Total	130		

* NZW and CH= New Zealand White and Chinchilla strains, respectively.

Statistical Analysis

Statistical analysis was performed by adopting linear regression using MINITAB statistical package (MINITAB, 2003). Data on body weight and linear body measurements of rabbits was used to predict body weight at various ages by genetic group, parity and sex.

RESULTS AND DISCUSSION

Predictive equations of rabbit individual body weight (IBW) at various ages by genetic group, parity and sex are presented in Tables 2, 3 and 4. Linear body measurements and body weight had significant ($P<0.05$; 0.01) associations except for pure CH at 35-days post-partum where no significant ($P<0.05$) effect was observed. The value of the coefficient of determination (R^2) ranged from 0.49 to 0.99 being maximal for CH x (CH x NZW) cross at 21 and 49-days post-partum. The R^2 values were generally high and positive signifying that the equations could be used to predict IBW efficiently. High and positive R^2 value for any trait with body weight is indicative of the fact that the trait has a propensity to increase as body weight increases. This implies that the trait is directly influenced by changes in body weight. According to Ozoje and Mgbere (2002) and Salako and Mgbere (2002), since the final body weight of an animal reflects the total of the weight of its component parts, predictive equations provides a readily available tool in estimating body weight especially in rural communities and in areas where standard weighing scales or balances are lacking or unavailable. The high and positive R^2 values observed in the study implies that 50 to 99 % of the variation contributing to body weight of rabbits could be attributed to the body parts measured. 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 (Isaac *et al.,* 2011).

CONCLUSIONS

Linear body measurements and body weight of rabbit had significant association except for CH pure breed at 35-days post-partum where no significant effect was observed and that body weight could be estimated accurately based on the value of the coefficient of determination (R^2).

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Table 2: Predictive equations relating body weight to linear body measurements at 21-days post-partum

Genetic group	Predictive equation	SE	R^2	LS
NZW	IBW = -357 + 7.80NTS – 11.45STL + 15.9HG + 1.92TL + 78.7LE	6.47	0.82	**
CH	IBW = -226 – 4.76NTS + 16.9STL + 4.99HG + 8.33TL + 2.90LE	4.90	0.77	**
NZW x CH	IBW = -256 + 28.00NTS + 13.70STL - 7.81HG + 3.62TL + 1.26LE	3.69	0.79	**
CH x NZW	IBW = -164 – 4.30NTS + 14.70STL + 18.50HG – 1.80TL – 8.60LE	5.52	0.73	**
NZW x (NZW x CH)	IBW = -357 + 4.79NTS + 4.79STL + 26.00HG – 6.30TL + 28.50LE	4.27	0.88	**
CH x (CH x NZW)	IBW = -279 – 32.80NTS + 33.20STL + 14.30HG – 29.30TL + 82.90LE	3.20	0.99	**
Parity				
1	IBW = -383 + 10.70NTS + 11.90STL + 13.50HG – 2.52TL + 27.00LE	2.90	0.75	**
2	IBW = -302 + 3.09NTS + 5.75STL + 16.80HG + 8.94TL + 5.02LE	4.13	0.76	**
Sex				
Male	IBW = -333 + 12.00NTS + 9.33STL + 13.30HG + 3.76TL + 7.38LE	3.01	0.78	**
Female	IBW = -338 – 5.87NTS + 11.90STL + 16.90HG + 2.52TL + 25.20LE	3.76	0.72	**

******(P<0.05) ; **** ***(P<0.05) ; R^2 = coefficient of determination; SE = standard error of mean; NZW = New Zealand White; CH = Chinchilla; LS = level of significance; IBW = individual body weight; NTS = nose to shoulder length; STL = shoulder to tail length; HG = heart girth; TL = trunk length; LE = length of ear.

Table 3: Predictive equations relating body weight to linear body measurements at 35-days post-partum

Genetic group	Predictive equation	SE	R^2	LS
NZW	IBW = -370 + 9.10NTS – 27.50STL + 18.00HG - 8.79TL - 4.70LE	6.33	0.86	**
CH	IBW = -341 + 29.20NTS + 9.90STL + 25.20HG - 2.80TL - 18.50LE	8.14	0.50	ns
NZW x CH	IBW = -526 + 44.90NTS - 5.38STL + 6.40HG + 6.40TL + 32.20LE	5.68	0.73	**
CH x NZW	IBW = -444 – 34.50NTS + 30.50STL + 4.70HG + 2.70TL + 59.40LE	8.87	0.87	**
NZW x (NZW x CH)	IBW = -686 + 7.90NTS - 11.60STL + 39.60HG + 21.90TL + 22.50LE	7.39	0.89	**
CH x (CH x NZW)	IBW = -849 + 29.70NTS + 37.95STL + 4.50HG – 11.50TL + 33.40LE	6.12	0.93	**
Parity				
1	IBW = -506 + 6.11NTS + 15.60STL + 0.277HG + 9.92TL + 39.60LE	4.53	0.73	**
2	IBW = -646 – 3.30NTS + 14.00STL + 31.80HG + 7.00TL + 14.70LE	6.58	0.89	**
Sex				
Male	IBW = -611 + 14.20NTS + 30.00STL + 0.417HG + 0.20TL + 23.10LE	5.35	0.82	**
Female	IBW = -441 – 7.84NTS + 16.20STL + 22.10HG + 9.09TL + 5.49LE	5.81	0.72	**

*****(P<0.05); **** ***(P<0.05) ; R^2 = coefficient of determination; SE = standard error of mean; NZW = New Zealand White; CH = Chinchilla; LS = level of significance; IBW = individual body weight; NTS = nose to shoulder length; STL = shoulder to tail length; HG = heart girth; TL = trunk length; LE = length of ear.

Table 4: Predictive equations relating body weight to linear body measurements at 49-days post-partum

Genetic group	Predictive equation	SE	R^2	LS
NZW	IBW = -662 - 13.30NTS + 18.90STL + 29.70HG + 21.20TL - 3.80LE	16.07	0.71	*
CH	IBW = -414 + 5.50NTS + 27.60STL + 8.70HG - 4.22TL + 13.70LE	9.25	0.71	**
NZW x CH	IBW = -639 - 19.60NTS + 31.80STL + 20.90HG - 14.10TL + 53.80LE	14.93	0.49	*
CH x NZW	IBW = -1207 – 42.30NTS + 15.15STL + 51.20HG – 5.00TL + 131.00LE	13.28	0.93	**
NZW x (NZW x CH)	IBW = -987 + 38.70NTS + 83.20STL + 54.70HG – 85.50TL - 34.70LE	12.39	0.86	**
CH x (CH x NZW)	IBW = -1169 + 70.40NTS - 14.10STL + 69.10HG + 5.20TL - 25.60LE	5.58	0.99	**
Parity				
1	IBW = -706 – 13.10NTS + 32.30STL + 21.10HG + 3.84TL + 17.90LE	7.26	0.78	**
2	IBW = -1465 + 12.80NTS + 26.40STL + 42.60HG – 0.30TL + 47.10LE	9.16	0.92	**
Sex				
Male	IBW = -1114 – 2.80NTS + 24.40STL + 20.60HG + 16.50TL + 43.00LE	9.17	0.85	**
Female	IBW = -716 – 17.40NTS + 24.70STL + 37.30HG – 4.61TL + 31.20LE	8.44	0.76	**

*****(p<0.05); **** (**p<0.01); R^2 = coefficient of determination; SE = standard error of mean; NZW = New Zealand White; CH = Chinchilla; LS = level of significance; BW = individual body weight; NTS = nose to shoulder length; STL = shoulder to tail length; HG = heart girth; TL = trunk length; LE = length of ear.