

GENETIC AND NON-GENETIC FACTORS AFFECTING MORPHOMETRIC CHARACTERISTICS IN SEVEN RABBIT GENOTYPES

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ABSTRACT

The study was conducted to examine the influence of genetic and non-genetic factors on phenotypic plasticity (morphology) in seven genotypes of Rabbit. In achieving the objectives, linear body measurements were taken on the Rabbits using flexible tape. They are body weight (BW), body depth (BD), body length (BL), tail length (TL), fore-limb length (FLL), hind-limb length (HLL) and ear length (EL). The genetic factors are breeds and sex while the non-genetic factor is season of the year. The coefficient of variability of traits showed low to moderate variability and ranged from 9.24% for HLL to 15.73% for TL. BW had high variability (35.88%). The breed of the rabbits have a significant influence on the morphometric characteristics ($P < 0.01$) with CalxNzw, Flemish giant, New Zealand Red and Dutch having the best performance. There was a significant effect of season on the morphometric characteristics ($P < 0.01$) with the wet season having the best performance. Pearson correlation coefficient among the morphometric characteristics showed strong, positive and significant relationships with the 'r' value ranging from 0.38 (BDxEL) to 0.82 (BWxBL). It can be concluded that morphology in rabbits is being influenced by the breed they belong to and the season at which measurements were taken, therefore breed and season should be considered in rabbit production for maximum productivity and good phenotypic plasticity.

Keywords: Morphological characteristics, genetic and non-genetic factors.

INTRODUCTION

Rabbit (*Oryctolagus cuniculus*) is one of the most productive meat producing species among all domesticated animals. The feeding habits offer no appreciable competition with man. It can subsist on green as basal diets. In addition, they have a number of characteristics that are advantageous to subsistence farming system, such as small body size, short generation interval and short gestation period of 30-31 days. The daily weight gain is high and a rapid growth rate, and sexual maturity (Aduku and Olukosi, 1990). The provision of suitable breeding stocks that are well adapted to backyard systems is a key requirement to the sustainability of low-input and smallholder rabbit production systems prevalent in many parts of the sub-Saharan Africa (Oseni, 2012). The challenge for smallholder rabbit units is the non-availability of the desired genotype(s) that can perform under low-input systems characterized mostly by sub-optimal management. As a potential solution, pure

and crossbred rabbits have received increasing attention (Lukefahr, 1998). Rabbits ranked third in protein content behind poultry and turkey and has overtaken the first two because of its low cholesterol content (Tsado *et al.*, 2013). With reference to this and other indices, there is the need to identify the productive potentials of rabbit stock and the factors that affect their productivity. Rabbits are relatively little known but are gaining an overwhelming popularity and wider acceptability lately. Therefore, this study was conceived to examine the effect of season, breed and sex on rabbit morphological characteristics, and to document the relatedness of these phenotypic attributes.

MATERIALS AND METHODS

The study was conducted in the Rabbit unit, Teaching and Research Farm, Bayero University Kano, Kano State, Nigeria. Kano state is located in the semi-arid area of North-West Nigeria within

the latitude 10^o33" and 12^o27" north of the equator and, longitude 7^o34" and 9^o29" east of the Greenwich meridian (KNARDA, 2006). The rabbit were kept under intensive management in hutches with feeding and drinking trough provided. The hutches were made of wood measuring 76x62x42 cm and chicken wire mesh, with a raised wooden stand at 90cm high from the concrete floor.

Data on body weight in kg using a weighing scale and six other linear body measurements in cm were taken following the description of (Akanno and Ibe, 2006). The measurement includes the following: (a) Body depth – the circumference of the thoracic cavity just behind the forelimb divide by two. (b) Body length – the diagonal distance from the point of the shoulder to the pin bone. (c) Tail length – the distance from the pin bone to the tip of the tail. Forelimb length – the distance from the hock to the proximal end of the humerus; Hindlimb length – the distance from the proximal end of the femur to the distal end of the fibula including the distal end of the femur; Ear length – the distance from the base of the ear to the tip.

Data were analyzed using the General Linear Model (Proc GLM) procedure of SAS^(R) (SAS, 2004). The GLM procedure includes fixed effect of sex and breed of rabbit, and season of measurement with body weight and morphometric measurements as response variables. Pearson correlation procedure of SAS was used to access the relationship among variables.

RESULTS AND DISCUSSION

Table 1 showed the summary statistics of the morphometric measurements indicating the means and coefficients of variability of the variables. The mean body weight ranged from 0.82kg to 1.35kg. These observed range of body weight are different from reports in the literature from sub-Saharan Africa due to age and management but very close to the report from Nigeria. For instance in Cameroon, (Lukefahr and Goldman, 1985) reported mean of 2.5kg for adult rabbits while means of 1.70kg, 2.1kg and 1.8kg were reported from Ghana, Malawi and Nigeria respectively (Omole, 1982). The table equally

showed the mean values for other morphometric measurements and their ranged values. The coefficient of variability was low for hindleg length (9.24%), foreleg length (9.76%) and ear length (9.29%) indicating that selection based on them would tends towards homozygosity. The remaining measurements had moderate variability ranging from 14.93% for body depth and 35.88% for body weight indicating that they are wide apart and require much more selection pressure.

Table 2 showed the effect of breed, season and sex on the morphometric parameters. The sex of the rabbit genotypes had no significant effect on the morphometric characteristics ($P>0.01$). The breed of the rabbits have a significant influence on the morphometric characteristics ($P<0.01$) with CalxNzw, Flemish giant, New Zealand Red and Dutch having the best performance. There was a significant effect of season on the morphometric characteristics ($P<0.01$) with the wet season having the best performance. These gave an indication that rabbit breeds and the season of production have influence on morphological characteristics in terms of body form and structure. Pearson correlation coefficient (Table 3) among the morphometric characteristics showed strong, positive and significant relationships with the 'r' value ranging from 0.38 (BDxEL) to 0.82 (BWxBL). These result are in agreement with (Yakubu and Ayoade, 2009) who recorded similar trends in a study involving New Zealand White and Chinchila crosses.

CONCLUSION AND RECOMMENDATIONS

This study showed that there were significant influences of season and breeds on phenotypic plasticity in the growth of rabbits. Selection based on any of any of the morphometric characteristics would be significant due to the phenotypic relationship among them. Therefore, rabbit crosses and few other breeds like Flemish giant, Dutch and New Zealand Red are good for maximum production in the wet season, and disposal in the dry season.

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Table 1. Summary statistics for morphometric characteristics measured

S/N	Variables	Mean	CV(%)	Min	Max
1	BW	1.07	35.88	0.82	1.35
2	BD	11.46	14.93	1.18	14.50
3	BL	31.15	15.22	19.00	39.50
4	TL	8.87	15.73	6.00	19.00
5	FLL	16.33	9.76	11.50	21.00
6	HLL	24.68	9.24	18.00	28.00
7	EL	10.62	9.29	8.50	19.00

The mean value and variables were clearly showed. BW = Body weight, BD = Body dept, BL = Body length, TL = Tail length, FL = Fore limb, HL = Hind limb, EL = Ear length.

Table 2. Effect of Breed, Sex and season on morphometric characters in rabbit genotype

Factors	BW	BD	BL	TL	FLL	HLL	EL
Breeds	**	**	**	**	**	**	**
CAL×NZW	1.35 ^a	12.86 ^a	33.86 ^a	9.56 ^{ab}	17.48 ^a	26.23 ^a	10.76 ^{ab}
FG	1.31 ^{ab}	12.51 ^{ab}	33.22 ^a	10.00 ^a	16.78 ^a	25.81 ^a	10.67 ^{ab}
NZR	1.23 ^{ab}	11.79 ^{bc}	32.97 ^a	9.11 ^{bc}	17.37 ^a	25.15 ^a	10.85 ^{ab}
DUT	1.12 ^{bc}	11.17 ^{cd}	32.76 ^a	9.01 ^{bc}	16.79 ^a	26.10 ^a	10.96 ^a
CH	0.95 ^{dc}	10.61 ^d	29.21 ^b	8.21 ^d	15.25 ^b	23.02 ^b	10.27 ^b
NZW	0.82 ^d	10.87 ^{cd}	29.38 ^b	8.53 ^{cd}	15.77 ^b	23.91 ^b	10.58 ^{ab}
BLK	0.82 ^d	10.88 ^{cd}	28.11 ^b	8.26 ^d	15.75 ^b	23.79 ^b	10.53 ^{ab}
SEM	0.08	1.04	0.36	0.31	0.33	0.46	0.23
Sex	NS	NS	NS	NS	NS	NS	NS
MALE	1.02	11.64	30.91	8.63	16.54	25.06	10.77
FEMALE	1.09	11.40	31.22	8.95	16.27	24.55	10.54
SEM	0.09	0.42	1.15	0.34	0.39	0.55	0.24
Season	**	**	**	**	**	**	**
DRY	1.00 ^b	11.09 ^b	30.34 ^b	8.65 ^b	16.19 ^b	24.42 ^b	10.59 ^b
WET.	1.35 ^a	12.89 ^a	34.34 ^a	9.74 ^a	16.90 ^a	25.69 ^a	10.73 ^a
SEM	0.09	0.38	1.08	0.32	0.38	0.54	0.24

**P(<0.01), SEM = Standard Error of Mean.

Table 3. Pearson correlation matrix for the morphometric traits of rabbit genotype

Factors	BW	BD	BL	TL	FL	HL	EL
BW	-						
BD	0.70**	-					
BL	0.82**	0.73**	-				
TL	0.57**	0.52**	0.65**	-			
FL	0.69**	0.64**	0.79**	0.58**	-		
HL	0.68**	0.65**	0.80**	0.62**	0.81**	-	
EL	0.40**	0.38**	0.54**	0.42**	0.47**	0.60**	-

**P(<0.01)