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Comparative Study on Rabbit Breeds for Post Weaning Growth Traits in the Humid Tropics of Nigeria

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ABSTRACT

Rabbit meat is a cheap source of high quality animal protein which could be reared in any agro-vegetational zone without any cultural and religious constraints. The rate of growth and reproductive ability of the different breeds differ, however. The aim of the present study was to determine the post weaning growth traits of exotic rabbit breeds which are commercially available in Nigeria. The two rabbit breeds used for this study were New Zealand White and California White. The study commenced from when the rabbits were 8 weeks old and lasted till 30th week of age. Analyzed data revealed that both breeds were not significantly (P>0.05) different in live body weight and linear measurements. Age of rabbits has significant effect (P<0.01) on all the traits evaluated, that is, all the body dimensions measured increased in size as the animals advanced in age. In addition, there was statistically significant (P<0.01) positive phenotypic correlations between live weight and linear measurements. This implies that all the body dimensions were good indicators of live weight and anyone of them could be used to predict its value. Age of rabbits also has significant positive phenotypic correlation with all the traits. There was significant breed x age interaction effects on all the traits measured. In this study, it was revealed that either of the two breeds could be used to cross with our local breeds of rabbits in order to improve their productivity.

Keywords: Breeds, growth, productivity, phenotypic correlation, rabbit, trait.

INTRODUCTION

Rabbit production is gradually becoming an important source of income and employment generation in Nigeria. It can also serve as alternative source of cheap animal proteins to mitigate the negative impacts of malnutrition in infants and adults which are prevalent in the developing countries. The only limiting factor reported to be affecting growth and productivity of rabbits in tropical and arid climates according to McNitt *et al*. (2000) is calorie stress associated with high ambient temperature. Rabbit meat provides a cheap source of meat which is characterized by a high protein and low fat cholesterol content (Aduku and Olukosi, 1990), and it is considered a delicacy and a healthy food product (Dalle Zotte, 2000). Rabbits have the potentials to supply good and high quality animal proteins, and are comparable to domestic chickens which have short gestation and generation interval, highly prolific, lack of taboos to its production and consumption, and can subsist on domestic waste and succulent leaves. In the tropics where there is stiff competition for grains and legumes between man and animals, rabbits can conveniently be reared in small or large scale since they can survive on forages and agricultural by-products not consumed by man. According to Lukefahr and Cheeke (1990), rabbit production occupies a vital role in the utilization of fibrous by-products that are not suitable for poultry or swine, and forages that may be available in insufficient quantities for raising ruminants. The most popular breeds used in commercial rabbit production are medium-sized ones such as New Zealand White and California (Ozimba and Lukefahr, 1991; Shemeis and Abdallah, 1998). Piles *et al*. (2000) and Shahin and Hassan (2002) documented that selection for high growth rate in rabbits had improved slaughter performance, but that it carries a high risk of lowering the quality of meat. Crossbreeding according to Nofal *et al*. (1997) is one of the fast tools offered to the breeders to improve many traits in farm animals. In a study involving New Zealand White and California, Maj *et al*. (2009) observed that crossbred rabbits were heavier than purebred animals. In Egypt, significant differences in body weights at various ages of local breeds had been documented (Khalil, 1997). In addition, McNitt and Lukefarh (1993) found that New Zealand White had significantly higher market weight and lower age than California, Palomino and White Satin breeds.

There are genetic and environmental factors affecting the post weaning growth rate of rabbits, and these include breed (Lukefahr *et al.*, 1983b; Ozimba and Lukefahr, 1991), sex (Afifi *et al*., 2000), season or month (Afifi and Emara, 1990). Oke *et al*. (2010) and Isaac *et al*. (2010) also observed significant differences in growth traits among breeds of rabbits. In addition, variations in growth rate or weight gain of rabbit within the same breed or among different breeds could be attributed to environmental factors such as nutrition, disease, hormone and general management. The documented breed differences in growth rate for exotic breeds could be exploited and used in breeding programme to develop a fast growing indigenous strain adaptable to hot environment. Adequate information is required in development and general recommendations for pure breeding or crossbreeding programmes on genetic and environmental factors affecting growth traits of both purebred and crossbred rabbits reared in a variety of climates. It is worthy to note that post weaning growth rate of an animal has effect on its reproductive activity, survival, age at market weight and other economic traits and value. The present investigation was therefore, undertaken to assess breed and age effects on post weaning growth traits of New Zealand White and California White. The aim was to identify and recommend the breed that can be used to upgrade and improve the growth potential of our local unimproved rabbits. The study also estimates the relationship between body weight and linear measurements so as to be able to predict the value of the former from the latter.

MATERIALS AND METHODS

Study location

The study was carried out at the Animal Breeding Unit, Teaching and Research Farm, Ekiti State University, Ado-Ekiti, between July, 2010 and December, 2010. Ado-Ekiti is situated along latitude $7^0 31^1$ and $7^0 49^1$ North of the Equator and longitude $5^0 71^1$ and $5^0 27^1$ East of the Greenwich Meridian. The city falls under Derived Savannah zone. The city enjoys two separate seasonal periods namely, Rainy (May-October) and Dry (November-April) seasons.

Population and Management of Rabbits

A total number of 10 rabbit kits (weaners) comprising of five kits each of New Zealand White and California White were purchased at 6 weeks old from a breeder farm, and kept in separate hutches made of wooden materials. The hutches were properly disinfected before the arrival of the rabbits. They were allowed two weeks to adapt to the new environment. They were dewormed and given necessary medications during the experimental period. Fresh and green leaves of *Tridax procumbens*, *Talinium triangulae* and *Aspergillia africana* were given, while pelletized feeds as supplements were also given at regular intervals. Fresh water was given *ad libitum.*

Traits Studied

Evaluation criteria in which breed-type comparisons were based included body weight at 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28 30 weeks. Linear body measurements taken were body length, ear length, trunk length, abdominal circumference, nose to shoulder and tail length, all in centimetres. Body weight was taken using a top loading scale, while other traits were measured using tailor's tape rule. All the animals were starved overnight, carefully restrained before they were measured in order to get accurate weight of the body.

Data Analysis

Data were collected on breed basis on all the studied traits and were subjected to T-test and significant differences between means were determined as per SAS (2001). Also, correlations between body weight and linear measurements were determined by Pearson Correlation analysis as per SAS (2001) computer package.

The appropriate statistical model used was:

$Y_{ijk} = \mu + G_i + A_j + (GA)_{ij} + €_{ijk}$

Y_{ijk}= observation of the k^{th} population, of the j^{th} age and of the i^{th} genotype

μ = common mean

G_i = fixed effect of i^{th} genotype (i=2)

A_j= fixed effect of j^{th} age (j=12)

$(GA)_{ij=}$ genotype x age interaction effect

$€_{ijk=}$ residual error

RESULTS

Breed and age effects

Table 1 shows the effects of breed and age on post weaning growth traits. There were no significant breed (P>0.05) differences in live body weight and linear measurements at 8^{th} week of age between New Zealand White and California White. The weanling rabbits were of the same age and size at the commencement of the experiment. Also from 10^{th} – 30^{th} week of age, the two breeds recorded similar mean values in live body weight and linear measurements.

Table 1. Least square means showing breed and age effects on body weight and linear measurements of two rabbit breeds

Age (weeks)	Breeds	Traits							
		Body weight	Body length	Ear length	Trunk length	Tail length	Abdominal circumference	Nose-shoulder	P-value
8	CLN	0.65	28.30	8.35	10.57	5.75	10.83	9.50	N.S
	NZW	0.65	27.67	8.97	11.63	5.65	10.50	9.75	N.S
10	CLN	0.83	28.73	9.08	11.60	6.53	11.53	9.85	N.S
	NZW	0.80	29.12	9.22	12.62	6.45	11.92	10.18	N.S
12	CLN	0.98	30.80	10.02	13.30	7.23	13.5	11.23	N.S
	NZW	0.93	30.47	9.65	13.45	7.07	13.0	11.15	N.S
14	CLN	1.28	33.50	10.32	14.07	7.52	14.28	11.60	N.S
	NZW	1.10	32.62	10.12	14.17	7.70	13.83	11.65	N.S
16	CLN	1.38	35.62	10.60	14.50	8.08	15.12	12.05	N.S
	NZW	1.28	33.88	10.40	14.53	7.97	14.68	12.18	N.S
18	CLN	1.53	37.17	11.05	14.90	8.37	16.02	12.73	N.S
	NZW	1.43	35.53	10.72	15.03	8.23	15.47	12.70	N.S
20	CLN	1.76	38.92	11.38	15.65	8.95	16.73	13.45	N.S
	NZW	1.63	37.30	11.03	15.48	8.73	16.50	13.15	N.S
22	CLN	1.83	40.40	11.60	16.33	9.18	17.48	13.83	N.S
	NZW	1.74	38.77	11.35	15.87	9.17	17.65	13.85	N.S
24	CLN	2.00	41.75	11.82	16.82	9.65	18.08	14.25	N.S
	NZW	1.95	40.20	11.55	16.27	9.60	18.32	14.00	N.S
26	CLN	2.10	42.53	12.10	17.27	10.22	18.63	14.80	N.S
	NZW	2.14	41.22	11.77	16.70	9.85	18.82	14.35	N.S
28	CLN	2.15	43.02	12.40	17.43	10.43	18.80	15.32	N.S
	NZW	2.22	42.33	11.95	17.07	10.25	19.10	15.13	N.S
30	CLN	2.37	44.30	12.73	17.70	10.77	20.13	16.30	N.S
	NZW	2.42	43.52	12.57	17.43	10.72	19.95	15.87	N.S

N.S: means along columns without superscripts are not significantly different (p>0.05). CLN: California White NZW: New Zealand White

Table 2 presents the combined analyses of phenotypic correlations between live body weight and linear measurements on one hand, and among various linear measurements on the other hand. Body weight has statistically significant (p<0.01) positive phenotypic correlations with body length (0.977), ear length (0.924), trunk length (0.918), tail length (0.911), abdominal circumference (0.966) and nose to shoulder (0.933). Furthermore, there were statistically significant (p<0.01) positive phenotypic correlations among the linear body measurements.

Table 2. Phenotypic correlations between live weight and linear measurements of rabbits (pooled data)

Traits	Age	Body weight	Body length	Ear length	Trunk length	Tail length	Abdominal circumference	Nose-shoulder
Age	1.00	0.925**	0.922**	0.882**	0.916**	0.897**	0.938**	0.953**
Body weight		1.00	0.977**	0.924**	0.918**	0.911**	0.966**	0.933**
Body length			1.00	0.947**	0.947**	0.930**	0.957**	0.954**
Ear length				1.00	0.937**	0.916**	0.903**	0.927**
Trunk length					1.00	0.922**	0.925**	0.956**
Tail length						1.00	0.909**	0.918**
Abdominal Circumferene							1.00	0.925**
Nose-shoulder								1.00

**P<0.01

In this study (Table 3), breed-basis analyses showed there were positive significant phenotypic correlations between live weight and linear measurements. In both California White and New Zealand White, age has positive and high significant phenotypic correlations with body weight, body length, ear length, trunk length, tail length, abdominal circumference and nose-tail.

Table 3. Phenotypic correlations between live weight and linear measurements in two rabbit breeds

Traits	Age	Body weight	Body length	Ear length	Trunk length	Tail length	Abdominal circumference	Nose-shoulder
Age	1.00	0.892**	0.929**	0.922**	0.946**	0.929**	0.915**	0.966**
Body weight	0.956**	1.00	0.976**	0.926**	0.902	0.908**	0.962**	0.915**
Body length	0.924**	0.981**	1.00	0.946**	0.944	0.948**	0.969**	0.952**
Ear length	0.844**	0.925	0.948**	1.00	0.933	0.952**	0.933**	0.926**
Trunk length	0.877**	0.947	0.963**	0.950**	1.00	0.946**	0.938**	0.960**
Tail length	0.867**	0.916	0.916**	0.883**	0.907	1.00	0.915**	0.951**
Abdominal circumference	0.962**	0.972	0.950**	0.873**	0.917	0.904**	1.00	0.923**
Nose-shoulder	0.942**	0.954	0.961**	0.931**	0.953	0.887**	0.929**	1.00

**P<0.01 Above diagonal- California White Below diagonal- New Zealand White

DISCUSSION

The non-significant (P>0.05) breed differences recorded in all the traits evaluated between the two breeds suggest that the two breeds have similar genetic background. The obtained results contradicted the findings of Oke *et al*. (2010) and Isaac *et al*. (2010) who found significant breed differences in linear measurements at different ages with the exception of shoulder to tail. The present study corroborates the findings of Ozimba and Lukefahr (1991) and Roberts and Lukefahr (1992) who asserted that there was small to non-significant breed differences for postweaning growth traits in breed comparison studies involving three breeds. The two breeds however, increased in body size and other body dimensions as the animals grew in age. The rate of change was high initially but slowed down from 16^{th} week to 22^{nd} week. This type of growth has been called a convex-shaped growth curve as reported in broilers (Marks, 1979).

The result of phenotypic correlation analyses implies that all linear body measurements are good determinants of body weight. That is, body weight could be predicted with greater accuracy using the values of anyone of body dimensions. In agreement with this study, Ige *et al*. (2005) found that linear body measurements are useful in live weight determination. The observed findings also presuppose that the growth in any body dimension will invariably result to increase in live weight. Similarly, the positive, significant phenotypic correlations recorded among linear body measurements indicate strong relationships between the various traits that are connected with animal growth. According to El-Labban (1999), positive relationships between these traits were as a result of pleiotrophic effects of genes and linkage effects which operate on these traits. Therefore, any attempt to perform phenotypic selection for one trait will consequently result in improvement of the other.

Breed-basis analyses indicate that the two breeds grew in size and linear parts with advancing age under normal conditions. Moreover, phenotypic correlation values between body weight and other linear parts were very high in the two breeds. This suggests possible strong and positive relationship between these traits, and the likelihood of pleiotrophic effect of genes operating on them. Therefore, any attempt to select for one trait in a breeding program will automatically result to improvement on other traits. Previous studies have indicated positive and significant correlations between live weight and body dimensions in farm animals, that is, body dimensions are good indicators and can be used to predict the body weight of an animal. The current study was in agreement with the findings of Ige *et al*. (2007) in local fowls, Kolawole and Salako (2010) in cane rat and Elamin and Yousif (2011) in Sudanese rabbits. In addition, age of the rabbits across the two breeds was found to have significant positive correlation with body weight and linear measurements. There was significant breed x age interaction effects on all the traits measured. This implies that growth traits in rabbits are breed and age dependent.

CONCLUSIONS

Since there were no significant breed differences in live body weight and linear measurements, anyone of the two breeds could be used to cross with our local breeds to improve their genetic potentials and productivity. The local breeds are hardy and heat tolerant but low in mature body weight in comparison with exotic breeds. The crossbreds will no doubt combine the quality traits of both the local and exotic rabbit breeds. Also, it was indicated in this study that body weight has significant positive phenotypic correlation with linear measurement, that is, all the linear parts are good determinants of body weight in rabbits. The phenotypic correlations between body weight and linear body parts on one hand were high and positive. On the other hand, there were significant positive correlations among the various linear measurements evaluated. This implies that improvement in any part will lead to increase in body weight and other linear body dimensions.

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