

Full Length Research Paper

Evaluation of post weaning morphometric traits among four breeds of rabbits in humid tropics

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Abstract

Growth is usually defined as increase in size of body weight at a given age. One of the main objectives in rabbit breeding is to increase post-weaning growth which highly determines subsequent performances in rabbits. The growth performance of ninety-six (96) rabbits which include California white, Palomino brown, New Zealand white and Havana black was monitored from weaning (4 weeks) to 12 weeks. Data obtained from the measurements was analysed using SAS 2010. New Zealand white had the highest body weight ($1320.59 \pm 20.04\text{g}$) followed by California and Palomino brown while Havana black had the least weight record ($991.65 \pm 15.06\text{g}$). The highest body length mean of $32.00 \pm 0.41\text{cm}$ was recorded for Californian while Havana black had the least value. New Zealand white also had the widest girth ($27.25 \pm 0.75\text{cm}$) followed by Californian, Palomino brown and Havana black. All the breeds studied had almost the same mean value for head length at week 12. The effect of sex was significant on body weight, body length, ear length and head length at 8 weeks and 12 weeks of age. It was observed that male had slightly higher values in body weight, body length and ear length than females. Sex effect was not significant ($p > 0.05$) on the heart girth of the rabbits at any age. Female rabbits have higher values of head length than their male counterparts at age 8 and 12 weeks. New Zealand white had better growth performance compared with Californian, Palomino brown and Havana black in a humid tropical environment.

Keywords: Post weaning, morphometric traits, humid tropics, breeds of rabbits

INTRODUCTION

Rabbit meat production has been on the increase in Nigeria in recent years. The feeding of rabbits offers no appreciable competition with man. This is because it can subsist on green as basal diets. The combinations of these characteristics are unique. Rabbits provide an excellent source of protein for human consumption and may play a significant role in solving the problem of meat shortage in developing countries (Abdel-Azeem *et al.*, 2007). It is characterized by a high protein and low fat and cholesterol content and it is considered as a delicacy and a healthy food product (Dalle Zotte, 2000). Rabbits have a number of other characteristics that might be advantageous to subsistence farming system, such as their small body size with a relatively short gestation

period average of 30-31 days. (Ortiz- Hernandez and Rubio-Luzano, 2001).

One of the main objectives in rabbit breeding is to increase post-weaning growth which highly determines subsequent performances in rabbits. Growth is usually defined as increase in size of body weight at a given age. Animal growth involves increase in size and changes in functional capabilities of the various tissues and organs of animals from conception through maturity (Adeleke *et al.*, 2010). According to Akanno and Ibe (2005), since growth is a complex set of genetically and environmentally controlled metabolic events, there are numerous factors that will contribute with more or less important effects upon its variation (genetic additive effects,

environmental factors). Several factors influence post weaning growth of rabbits. Breed comparison study conducted in the United State involving the medium sized New Zealand white, Californian, Champagne D'Argent and Palomino breeds have demonstrated small to non-significant differences for post weaning growth performance (Roberts and Lukefahr, 1992) in temperate country. Ghosh *et al.* (2004) found no significant differences among breeds in body weight at different ages.

However climatic variations have definite effects on rabbit productivity. Ondruska *et al.* (2011) reported that total and daily feed intake, feed conversion ratio, and total and daily gain in body weight for growing rabbits were affected negatively by elevated temperature. Selection of suitable breed of rabbit to particular environment conditions is very much essential for successful rabbit production (Kumaresan *et al.*, 2011). This study is therefore conducted to compare the body weights and morphometric traits of New Zealand white, Californian, Havana black and Palomino brown breeds which are all temperate breeds in a humid tropical environment.

MATERIALS AND METHOD

Experimental Site

The experiment was carried out at the rabbitry unit of the Department of Environmental Biology and Fisheries, Adekunle Ajasin University Akungba-Akoko, Ondo state. Akungba-Akoko is located in Akoko South West Local Government Area of Ondo State, Nigeria. The area lies in the south western region of Nigeria (7° 28' and 5° 43') and has the following environmental condition: ambient temperature of 27°C and relative humidity of 46mm Hg.

Experimental Animals and Management

Ninety-six (96) rabbits which include California white, Palomino brown, New Zealand white and Havana black. Palomino brown rabbits are golden brown and lynx, they are large meaty rabbits. Californian white rabbits are rounded in body and have short smooth coat. They are first bred in the 1920's with the intent of creating a better commercial meat rabbit, as a result of crosses between the Himalayan, and the standard Chinchilla. New Zealand white are multipurpose breed because they can be raised for meat, pets and laboratory purpose. The Havana black rabbit was first discovered in the Netherland.

The experimental animals were kept in a wooden cage with each compartment of dimension of length x width x height: 80 x 50 x 30 cm³. The cages were constructed of wood and a wire mesh. The hutch was constructed in a way that it allow there waste to drop on

the floor easily and has a single roof which covers all cages from rain or sunlight. They were fed with commercial pelleted diet; the diet used contained 15% Crude protein, 7% fat, 10% Crude fibre, 1.0% Calcium, together with available phosphorus of 0.35% and 2550 Kcal/kg metabolisable energy. They were also supplied with forages. Clean water was also supplied to the rabbits *ad libitum*.

Data Collection

The following traits were measured: body length, body weight, heart girth, and ear length, and head length, height at wither and tail length. The post weaning measurements were taken at the interval of four weeks from weaning (one month) to when they were three months old. The measurements were taken in the morning before they were fed.

Body Weight (BW)

The total body weight of each rabbit was taken by placing the rabbit on the sensitive scale and the measurement was taken in grams.

Body Length (BL)

The total trunk length of the rabbit is just behind the neck to the beginning of the tail which was taken using tape rule which was calibrated in cm.

Heart Girth (HG)

This was measured just behind the fore legs as the circumference of the body using a measuring tape in cm.

Ear Length (EL)

The ear length was measured by placing the taperule at the ear region and the measurement was taken in cm.

Head Length (HL)

This was determined by placing the tape rule just behind the neck region to the tip of the mouth in cm.

Statistical Analysis

Data obtained from the measurements was analysed using SAS 2010. The linear model is as specified below:

$$Y_{ijk} = \mu + A_i + B_j + (AB)_{ij} + e_{ijk}$$

Y_{ijk} = the parameter of interest

μ = overall mean for the parameter of interest

A_i = Fixed effect of i th breed ($i=1-3$)

B_j = Fixed effect of j th sex ($j=1-2$)

$(AB)_{ij}$ = Interaction effect of i th breed and j th sex

e_{ijk} = random error associated with each record (Normally = Independently and identically distributed with zero mean and variance ($\delta^2 e$))

RESULTS

The analysis of variance showed that breed had significant ($p < 0.01$) effect on body weight and other morphometric traits at the post-weaning weeks. The least square mean for body weight on [Table 1](#) showed

Table 1: Least square mean and mean standard error of mean of body weight (g) as affected by breed and sex.

BREED	4 WEEKS	8 WEEKS	12 WEEKS
Palomino brown	618.75±23.03 ^a	810.60 ± 25.14 ^a	1071.83 ±17.08 ^c
Californian	500.28±31.67 ^b	791.62 ± 30.05 ^a	1201.94 ± 19.07 ^b
New Zealand white	525.36±12.24 ^b	799.63 ± 20.94 ^a	1320.59 ±20.04 ^a
Havana black	450.28±32.67 ^c	675.36± 22.12 ^b	991.65 ± 15.06 ^d
SEX			
Male	570.38±21.47	795.25 ± 15.91 ^a	1291.94 ± 14.07 ^a
Female	565.16±15.14	742.14 ± 17.92 ^b	1071.94 ± 13.57 ^b

Means on the same row with the different superscript are significantly different ($p < 0.05$).

Table 2: Least square mean and standard error of mean of body length (cm) as affected by breed and sex.

BREED	4 WEEKS	8 WEEKS	12 WEEKS
Palomino brown	27.75 ±0.29 ^b	31.00±0.77 ^a	32.00 ±0.48 ^b
Californian	29.42 ±0.12 ^a	29.96±0.96 ^b	33.87 ±1.21 ^a
New Zealand white	27.41 ±0.45 ^b	27.83±0.37 ^c	29.67 ±0.15 ^c
Havana black	25.98 ± 0.46 ^d	26.97± 0.23 ^d	28.10 ± 0.19 ^d
SEX			
Male	27.98±0.67	28.25±0.81 ^a	29.02± 1.14 ^a
Female	27.57±0.41	27.86 ±0.14 ^b	28.38 ±0.91 ^b

Means on the same row with the different superscript are significantly different ($p < 0.05$).

that at week 4 (when the rabbits were weaned), Palomino brown breed had the highest mean of (618.75±23.03g) while Californian and New Zealand white had almost the same mean of 500.28±31.67g and 525.36±12.24g respectively while Havana black had the least value (450.28±32.67g). At week 8, there were no significant differences in the body weight of Palomino brown, Californian and New Zealand breed, nevertheless, Havana black had the least value. However at week 12, New Zealand white had the highest bodyweight record

(1320.59 ±20.04g) followed by California and Palomino brown while Havana black maintained the least weight record (991.65 ± 15.06g).

The least square mean for body length as affected by breed is shown in Table 2. At weaning, Californian breed had the longest body of 29.42 ±0.12cm, followed by Palomino brown and New Zealand white with nearly the same body length of 27.75±0.62cm and 27.41±0.45cm respectively. The least square mean recorded at week 8 showed that Palomino brown had the highest mean

Table 3: Least square mean and mean standard error of mean of heart girth (cm) as affected by breed and sex.

BREED	4 WEEKS	8 WEEKS	12 WEEKS
Palomino brown	21.68 ±0.49 ^c	22.30 ±0.77 ^c	24.27 ±0.78 ^c
Californian	22.94± 0.24 ^b	23.76 ±0.34 ^b	25.77 ± 0.29 ^b
New Zealand white	24.83 ± 0.41 ^a	25.00± 0.63 ^a	27.25 ±0.75 ^a
Havana black	20.89 ± 0.65 ^d	21.96 ±0.89 ^d	23.68 ± 0.06 ^d
SEX			
Male	22.68 ±0.39	23.62±0.63	24.33 ± 0.85
Female	22.67 ±0.41	23.61±0.65	24.44 ± 0.65

Means on the same row with the different superscript are significantly different (p<0.05).

Table 4: Least square mean and mean standard error of mean of ear length as affected by breed and sex.

BREED	4 WEEKS	8 WEEKS	12 WEEKS
Palomino brown	8.85±0.28	9.72± 0.06 ^b	10.52±0.13 ^b
Californian	8.84±0.12	9.30±0.12 ^c	9.72±0.16 ^c
New Zealand White	8.83±0.37	9.40±0.06 ^c	9.75±0.05 ^b
Havana black	8.82±0.51	10.35±0.23 ^a	11.15±0.05 ^a
SEX			
Male	8.83±0.21	9.75±0.14 ^a	10.13±0.06 ^a
Female	8.70±0.16	9.47±0.05 ^b	10.01 ±0.05 ^b

Means on the same row with the different superscript are significantly different (p<0.05).

Table 5: Least square mean and mean standard error of mean of head length as affected by breed and sex.

BREED	4 WEEKS	8 WEEKS	12 WEEKS
Palomino brown	8.27±0.08 ^c	10.70±0.22 ^b	12.01±0.34
Californian	10.11±0.10 ^b	10.97±0.18 ^b	12.30±0.15
New Zealand white	10.56±0.13 ^a	11.31±0.15 ^a	12.37±0.13
Havana black	10.01±0.20 ^b	10.53±0.12 ^c	12.25±0.11
SEX			
Male	9.98±0.12	10.86±0.152 ^b	12.27±0.10 ^b
Female	9.97±0.14	11.17±0.123 ^a	12.41±0.12 ^a

Means on the same row with the different superscript are significantly different (p<0.05).

(31.00 ± 0.77cm) while the least value was recorded for Havana black (26.97± 0.23cm) At week 12, the highest body length mean of 32.00 ±0.41cm was recorded for Californian while Havana black had the least value.

The least square mean for heart girth as affected by breed is presented in Table 3. At week 4 observations showed that mean ranged from 20.89 ±0.65 to 24.83±0.41cm with New Zealand white showing the highest mean. The observed least square means at week 12 showed that New Zealand white also had the

widest girth (27.25±0.75cm) followed by Californian, Palomino brown and Havana black.

There was no significant difference in the ear length at weaning (4weeks). However the effect of breed became significant on the length of the ear at 8weeks and 12 weeks of age with the Havana black showing the highest mean followed by Palomino brown. Californian and New Zealand breed had similar ear length (Table 4).

The least square mean for head length as affected by breed is shown in Table 5. At week 4 it was recorded that

New Zealand white breed had the highest mean of 10.56 ± 0.13 cm, while Palomino brown breed had the least mean of 8.27 ± 0.08 cm. The least square mean for week 8 shows that Palomino brown breed and Californian had almost the same mean value of 10.70 ± 0.12 cm and 10.97 ± 0.17 cm respectively while breed New Zealand had the highest mean of 11.31 ± 0.15 . However at week 12, it was observed that all the breeds had almost the same mean value for head length.

At weaning (4 weeks), similar body weight were recorded for both male and female and respectively. Nevertheless, it was observed that at 8 weeks of age, male were slightly heavier than females. The bucks were also heavier than the does at 12 weeks of age. The least square mean for body length as affected by sex showed that at 4 weeks, there was no statistical difference in the body length of male and female rabbit. However at week 8, the male rabbits had the higher mean body length (28.25 ± 0.81 cm) compared with their female counterpart with 27.86 ± 0.14 cm. In the same trend, there was significant difference between male and female rabbit (29.02 ± 1.14 cm and 28.38 ± 0.91 cm respectively) at week 12. The effect of sex was not significant ($p > 0.05$) on the heart girth of the rabbits at any age. The observed least square mean for heart girth was nearly the same for male and female rabbits at week 4, 8 and 12.

Sexual dimorphism was not expressed in ear length until 8 weeks of age when the effect of sex was significant ($p < 0.05$) on ear length with the male having higher values than the females at 8 and 12 weeks of age. Female rabbits have higher values of head length than their female counterparts at age 8 and 12 weeks.

DISCUSSION

The higher values obtained for New Zealand white breed rabbits in this study could be as a result of their ability to tolerate high ambient temperature and high relative humidity associated with humid tropics. McNitt and Lukefahr (1993) reported that New Zealand White rabbits tended to be less affected by the environmental extremes (during summer) than Californian, Palomino and White Satin breed. New Zealand White had higher weight gain than Californian, Palomino and White Satin breed. According to McNitt and Lukefahr (1993), Day length may be an important factor in post-weaning fryer performance as elevated temperature causes reduction in feed intake and weight gain. Growth performance of New Zealand White breed tends to be less sensitive to the climatic extremes. New Zealand White breed had the best growth under hot humid climate while the White Satin seemed to follow the New Zealand White closely in growth performance.

Akinsola *et al.* (2014) reported that New Zealand white had the higher values in traits such as ear length, body length, body weight and tail length compared to

Californian crossbred rabbit. However cross bred California rabbit showed higher values in traits such as height at wither and heart girth compared to the purebred New Zealand White rabbits. Ozimba and Lukefahr (1991) reported that Palomino X New Zealand White crossbred litters gained more slowly from 28 to 70 days than did Californian X New Zealand White crossbred litters whereas New Zealand White pure bred litters did not differ from these two crossbred groups. According to Ouyed and Brun (2008) rabbit progenies from New Zealand White dams had better growth performances (average daily gain and live weight) than those from Californian dams. Prayaga and Eady (2003) reported that Californian purebreds and crossbreds had lower performance in all body growth compared with other breeds studied.

Havana black had the least value for body weight and other body measurements apart from ear length. This could be as a result of their coat pigmentation which absorbs heat from the environment. According to Fadare (2014), the heat stress index for Havana black rabbit is very high in the humid tropics. Marai *et al.* (2001) reported that elevated temperature and humidity adversely affects live body weight, daily weight gain and feed intake of growing rabbits. Digestibility coefficient for dry matter, crude protein and crude fibre usually decline in rabbit due to heat stress.

However, according to Roberts and Lukefahr (1992), breed comparison studies involving the New Zealand White, Californian, Champagne Argent and Palomino breeds demonstrated small to non-significant differences for post weaning growth traits. Higher values in body weight, body length and ear length of male rabbits over their female counterparts at 8 weeks and 12 weeks of age in this study could be attributed to difference in their genetic makeup and influence of hormones. Akpobasa (2012) reported that buck had significant higher body weight, withers height, rump height, body length, face length, chest circumference, head width, shoulder width and rump width compared to their doe counterparts.

CONCLUSION

New Zealand white breed had the highest mean of body weight followed by California and Palomino brown while Havana black had the least weight record at week 12. The highest body

length mean was recorded for Californian while Havana black had the least value. New Zealand white also had the widest girth. New Zealand white breed had the highest mean of head length at week 4 and week 8. However at week 12, all the breeds had almost the same mean value for head length. New Zealand white had better growth performance compared with Californian, Palomino brown and Havana black in a humid tropical

environment. Male had slightly higher values in body weight, body length and ear length than females at 8 weeks and 12 weeks of age. Male and female rabbits had similar values of heart girth at post-weaning age. Female rabbits have higher values of head length than their female counterparts at age 8 and 12 weeks.

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