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EVALUATION OF POST WEANING MORPHOMETRIC TRAITS AMONG FOUR BREEDS OF RABBITS IN HUMID TROPICS

***Fadare A.O., Saliu , G.O and Adeniyi T.K**

Department of Animal and EnvironmenatBiology,
AdekunleAjasin University, Akungba-Akoko.Ondo-State. Nigeria.
E-mail: fadare.adelodun@aaua.edu.ng

ABSTRACT

Rabbit breeding is aimed at increasing post-weaning growth which invariably determines subsequent performances in rabbits. The growth performance of ninety-six (96) rabbits of four breeds (California white, Palomino brown, New Zealand white and Havana black) was monitored from weaning (4 weeks) to 12 weeks. New Zealand white had the highest body weight (1320.59 ±20.04g) followed by California and Palomino brown while Havana black had the least weight record (991.65 ± 15.06g). The highest body length mean of 32.00 ±0.41cm was recorded for Californian while Havana black had the least value. New Zealand white also had the widest girth (27.25±0.75cm) followed by Californian, Palomino brown and Havana black. All the breeds studied had almost the same mean value for head length at week 12. Body weight and other morphometric traits(body length, earlength, head length) differed significantly between bucks and does at 8 weeks and 12 weeks of age. It was observed that males had slightly higher values in body weight, body length and ear length than females. Hearth girth of rabbits did not differ significantly ($p > 0.05$) between the sexesof rabbits at any age. The head length of female rabbits had higher values of head length than those of male rabbit their female at age 8 and 12 weeks. In conclusion, New Zealand white had better growth performance compared with Californian, Palomino brown and Havana black in a humid tropical environment.

***Keywords**:* Morphometric traits, Weaning, Rabbit, Humid tropics

1.0 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 (DalleZotte, 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. The rabbit productivity is greatly influenced by post weaning kits growth potential and the number that survives up to market (Assan, 2018). Growth is 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

***Corresponding Author**

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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. A 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 in Tripura, India. Apart from the genetic variation, environmental factors are also important in the growth of rabbit.

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 temperate breeds such as New Zealand white, Californian, Havana black and Palomino brown breeds in a humid tropical environment.

2.0 MATERIALS AND METHOD

2.1 Experimental site

The experiment was carried out at the rabbitry unit of the Department of Animal and Environmental Biology ,AdekunleAjasin 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 (7º 28ˈand 5º43ˈ) according to Geographical Positioning System (GPS) and has the following environmental condition: ambient temperature of 27^{0}C and relative humidity of 46mm Hg.

2.2 Experimental animals and management

Ninety-six (96) rabbits which include California white, Palomino brown, New Zealand white and Havana black were used for this study. Palomino brown rabbits are golden brown and lynx, they are large meaty rabbits. Californian white rabbits are rounded in body and have short smooth coats. Theyresulted fromcrosses 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 Netherlands. The experimental animals were kept in a wooden cage with compartment . Each compartment of dimension (length× width× height) of 80× 50 ×30 cm^3. The hutch was constructed in a way that it allowed waste to drop on the floor easily and had a single roof which covered cages from rain or sunlight. They were fed with commercial pelleted diet which contained 15% Crude protein, 7% fat, 10% Crude fibre, 1.0% Calcium, together with available phosphorus of 0.35% and 2550Kcal/kg metabolisable energy. They were also supplied with freshforages cut at the back of the rabbitry unit. Clean water was also supplied to the rabbits ad- libitum.

2.3 Data Collection

The following traits were measured: body length, body weight, heart girth, ear length, head length, height at wither and tail length. The post weaning measurements were taken at the interval of four weeks commencing 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 (g).

Body Length (BL): The total trunk length of the rabbit is just behind the neck to the beginning of the

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tail which was taken using tape rule calibrated in centimeter (cm).

Heart Girth (HG): This was measured incentimeter (cm) using a measuring tape. The heart girth is the circumference of the body taken immediately behind the fore legs.

Ear Length (EL): The ear length was measured by placing the tape rule 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. The measurement was recorded in cm.

2.4 Statistical analysis

Data obtained from the measurements was analysed using (SAS 2010) and linear model is as derived below:

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

Y_{ijk}= the parameter of interest

μ = overall mean for the parameter of interest

A_i = Fixed effect of ith breed (I=1-3)

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

(AB)ij = Interaction effect of ith breed and jth sex
e_{ijk}= random error associated with each record (Normally= Independently and identically distributed with zero mean and variance ($ð^2e$)

3.0 RESULTS

The analysis of variance showed that breeds differed significantly ($p<0.01$) in terms of body weight and other morphometric traits at the post-weaning weeks. The least square mean for body weight summarized on Table 1 showed 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±12.24grespectively 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 body weight record (1320.59 ±20.04g) followed by California and Palomino brown while Havana black maintained the least weight record (991.65 ± 15.06g). At weaning (4weeks), 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 as shown on Table 1.

The least square mean for body length in the different breeds is shown on 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 (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. A shown on Table 2, there was no statistical difference in the body length of male and female rabbitat 4 weeks,. However at week 8, the male rabbits had the higher mean body length (28.25±0.81cm) compared with their female counterpart with 27.86 ±0.14cm. In the same trend, there was significant difference in the body length of male and female rabbit (29.02±1.14cm and 28.38±0.91cm respectively)at week 12.

The least square mean for heart girth as affected by breed is as presented in Table 3. At week 4 , heart girth 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 blackThe 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

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and female rabbits at week 4, 8 and 12 as presented on Table 3.

There was no significant difference in the ear length of breeds at weaning (4weeks). However the significant increases on the length of the ear at 8weeks and 12 weeks of age were observed with the Havana black showing the highest mean followed by Palomino brown. Californian and New Zealand breed had similar ear length (Table 4).Sexual dimorphism was not expressed in ear length until 8 weeks of age with the male having higher values than the females at 8 and 12 weeks of age.

The highest mean for head length at week 4 was recorded among New Zealand white breed (10.56±0.13cm) while Palomino brown breed had the least mean of 8.27±0.08cm (Table 5) The least square mean at week 8 shows that Palomino brown breed and Californian had almost the same mean value of 10.70±0.12cm and 10.97±0.17cmrespectively 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. Female rabbits have higher values of head length than their female counterparts at age 8 and 12 weeks.

4.0 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 also to be less sensitive to the climatic extremes. New Zealand White breed had the best growth under hot humid climate .

According to Lavanya*et al.* (2017), breed influence body weight and average daily gain at all ages during post-weaning phase.

In this study, New Zealand white rabbits had higher values in some morphometric traits, this is in line with the findings of Akinsola*et al.* (2014) who reported that New Zealand white had 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. The weight of Californian rabbits were significantly higher at 12 weeks than the Palomino brown rabbits in this study. However Ozimba and Lukefahr (1991) reported that Palomino crossbred litters gained more slowly from 28 to 70 days (post weaning period) than Californian crossbred litters. According to Ouyed and Brun (2008) rabbit progenies from New Zealand White dams had better growth performances (average daily gain and live weight) that 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. Post weaning growth traits are highly heritable, therefore selection of heavier kits could results in the improvement of body weights of rabbit (Assan , 2018)

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 *etal.*(2001) reported that elevated temperature and humidity adversely affects live body weight, daily weight gain and feed intake of growing rabbits. Digestibility coefficientfor 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, the New Zealand White, Californian, Champagne Argent and Palomino breeds demonstrated small to non –

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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) also has reported that buckreared 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.

5.0 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 post weaning morphometric traits compared with Californian, Palomino brown and Havana black in a humid tropical environment. Selection of New Zealand rabbits for production could help in achieving better post weaning growth of rabbit in the humid tropics . 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 male counterparts at age 8 and 12 weeks.

TABLE 1: Mean Body weight (g) of rabbits by breed and sex.

Body weight (g)

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: Mean Body length (cm) of rabbits by breed and sex.

Body length (cm)

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 ($p<0.05$).

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TABLE 3: Mean Heart girth (cm) of rabbits by breed and sex.

Heart girth (cm)

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: Mean Ear length (cm) of rabbits by breed and sex.

Ear length

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: Mean Body weight (g) of rabbits by breed and sex.head length of rabbits as affected by breed and sex.

Head length

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=0.1
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 ($p<0.05$).

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