



## FEED UTILIZATION STUDY ON SOME BREEDS OF RABBIT IN THE HUMID TROPICAL REGION



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**Abstract:** In this study, feed utilization of ninety-six (96) rabbits which include New Zealand white, Californian, Palomino brown and Havana black rabbits raised in the humid tropics were appraised. The experiment was carried out at the rabbitry unit of the Department of Animal and Environmental Biology, Adekunle Ajasin University Akungba-Akoko, Ondo state. Feed intake, weight gain and feed efficiency were determined after weaning (at 4 weeks) for a period of 8 weeks. The analysis of variance showed that the breed of rabbit had significant effect ( $P < 0.05$ ) on feed intake, weight gain and feed efficiency. The highest feed intake ( $79.95 \pm 3.43$  g) was recorded for New Zealand White rabbit followed by Palomino Brown and Californian breed while the least value of  $68.35 \pm 3.94$  g was recorded for Havana Black rabbit. There was no significant difference in the weight gain of Palomino Brown and Havana Black breed with  $803.42 \pm 23.58$  g and  $798.54 \pm 19.37$  g, respectively. New Zealand White rabbit had the highest value for feed efficiency ( $0.24 \pm 0.02$ ) followed by Californian ( $0.20 \pm 0.01$ ) while the least value of  $0.18 \pm 0.01$  was recorded for Havana Black rabbit. The effect of sex of animal was significant on the feed utilization of rabbit in this study. Male rabbits were superior to female counterparts with respect to feed intake, weight gain and feed efficiency. In conclusion, New Zealand White rabbit had better feed intake and feed efficiency when compared with Californian, Palomino Brown and Havana Black rabbit in the humid tropics.

**Keywords:** Breed, feed intake, feed efficiency, humid tropics, rabbit

### Introduction

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). The meat of rabbits 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). High prolificacy and early attainment of puberty make rabbit an ideal animal for meat production in developing tropics. The growth of rabbit, like other animals depends on feed consumption and utilization. According to Jiao *et al.* (2014), there is a moderate positive genetic correlation between growth and feed intake as well as a positive correlation between average daily gain and feed conversion ratio. Feed consumption which is generally expressed in terms of dry matter intake is the weight of feed material consumed excluding the moisture it contains. A large number of factors affect the dry matter intake of animals. This includes breed, age, physiological status, palatability of the feed among others.

Rabbit production under tropical conditions is affected by environmental stress mainly from the effect of high ambient temperatures and high humidity, low wind speed and indirect solar radiation. Excessive temperature and humidity induces physiological stress in rabbits (Marai *et al.*, 2001). The impact of heat stress on rabbit has been reported by various authors. 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. According to Marai *et al.*, (2002), animals with higher heat load make effort to dissipate body heat resulting in increased body temperature, as well as increase in consumption of water and a decline in feed intake. Selection of suitable breed of rabbit to a particular environmental condition is very much essential for successful rabbit production (Kumaresan *et al.*, 2011). This study was therefore carried out to investigate the feed utilization of

Californian, New Zealand white, Havana Black and Palomino Brown in a humid tropical environment

### Materials and Methods

#### Experimental site

The experiment was carried out at the rabbitry unit of the Department of Animal and Environmental Biology 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 ( $7^{\circ}28'$  and  $5^{\circ}43'$ ) and has the following environmental conditions: ambient temperature of  $27^{\circ}\text{C}$  and relative humidity of 46 mmHg.

#### Experimental animals and management

Ninety-six (96) rabbits which include (24) California White, (24) Palomino Brown, (24) New Zealand White and (24) Havana Black were used for the experiment. The experimental animals were kept in a wooden cage with each compartment of dimension of length  $\times$  width  $\times$  height:  $80 \times 50 \times 30$  cm<sup>3</sup>. Each rabbit was housed in separate compartments of the cages. 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 metabolizable energy. They were also supplied with forages. Feed and water were provided for *ad-libitum* consumption.

#### Performance evaluation

Feed intake, weight gain and total feed efficiency were determined after weaning (at 4 weeks) for a period of 8 weeks.

**Feed intake:** A quantity of concentrate feed was given to each of the rabbits housed in the separate compartments of the cages. The amount of feed left over was weighed and subtracted from the amount of feed given to determine daily feed intake within 24 hours.

**Weight gain** = Final weight – Initial weight

**Total feed efficiency:** Feed efficiency of rabbits was determined by calculating the ratio of total feed intake to total weight gain as follows:

$$\text{Total feed efficiency} = \frac{\text{Total weight gain (g)}}{\text{Total feed intake (g)}}$$

**Statistical analysis**

Data obtained from the measurement was analysed using SAS (2010) of GLM procedures of ANOVA. The linear model is as specified below:

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

$Y_{ijk}$  = the parameter of interest

$\mu$  = overall mean for the parameter of interest

$A_i$  = Fixed effect of  $i$ th breed ( $i=1-4$ )

$B_j$  = 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 ( $\sigma^2_e$ ))

Means were compared using Duncan Multiple Range Test procedure of the same statistical software

**Results and Discussion**

Table 1 show the least square means for feed intake, weight gain and feed efficiency of New Zealand White, California White, Palomino Brown and Havana Black rabbit. Breed effect was significant ( $p < 0.05$ ) on feed intake. The highest feed intake ( $79.95 \pm 3.43$  g) was recorded for New Zealand White rabbit followed by Palomino Brown ( $73.17 \pm 5.24$  g) and California White breed while the least value of  $68.35 \pm 3.94$  g was recorded for Havana Black rabbit. New Zealand White rabbit had better feed intake when compared with Havana Black rabbit in the humid tropics. The influence of breed was significant ( $p < 0.05$ ) on the weight gain of rabbit. The highest average daily weight gain ( $18.46 \pm 1.02$  g) and total weight gain ( $1033.69 \pm 76.35$  g) was recorded for New Zealand White

rabbit as shown on Table 1. The average daily weight gain of Palomino Brown and Havana Black breed were statistically similar. Also, there was no significant difference in the total weight gain of Palomino Brown and Havana Black breed with  $803.42 \pm 23.58$  g and  $798.54 \pm 19.37$  g, respectively.

New Zealand White rabbit had better feed intake and weight gain when compared with Havana Black and Palomino Brown rabbit in the humid tropics probably due to low absorption of heat which is directly related to the degree of pigmentation which enhances appetite. Animals with dark pigmentation are predisposed to higher heat load. The lighter coat pigmentation is reflective and absorbs less solar radiation (Adedeji *et al.*, 2011; McManus *et al.*, 2011; Fadare *et al.*, 2012). Low absorption of heat enhances more appetite and better feed intake resulting in faster growth. The least value of feed intake and total feed efficiency recorded for Havana Black rabbit could be as a result of their dark coat colour which absorbs heat from the humid tropical environment.

The total feed efficiency was significantly ( $p < 0.05$ ) affected by the breed of rabbit in this study. New Zealand White rabbit had the highest value for feed efficiency ( $0.24 \pm 0.02$ ) followed by California White ( $0.20 \pm 0.01$ ) while the least value of  $0.18 \pm 0.01$  was recorded for Havana Black rabbit. The least value of average feed intake, average weight gain, total weight gain and total feed efficiency were recorded for Havana Black rabbit when compared with New Zealand White, California White and Palomino Brown in an environment characterized with elevated ambient temperature and high relative humidity.

**Table 1: Daily feed intake and weight gain, and feed efficiency of different rabbit breeds**

Parameters	New Zealand White	California White	Palomino Brown	Havana Black
ADFI, g	79.95± 3.43 <sup>a</sup>	69.36±4.20 <sup>c</sup>	73.17±5.24 <sup>b</sup>	68.35±3.94 <sup>c</sup>
ADWG, g	18.46± 1.02 <sup>a</sup>	14.81± 0.24 <sup>b</sup>	14.37±0.16 <sup>c</sup>	14.26±0.21 <sup>c</sup>
Total weight gain, g	1033.69±76.35 <sup>a</sup>	829.35±36.53 <sup>b</sup>	803.42±23.58 <sup>c</sup>	798.54±19.37 <sup>c</sup>
Total feed intake, g	4477.20±107.23 <sup>a</sup>	3884.16± 141.5 <sup>b</sup>	4097.52 ±134.20 <sup>a</sup>	3827.60±154.10 <sup>b</sup>
Total feed efficiency	0.24 ±0.02 <sup>a</sup>	0.20±0.01 <sup>b</sup>	0.19 ± 0.01 <sup>b</sup>	0.18 ±0.01 <sup>c</sup>

<sup>a b c</sup> Mean on the same row with different superscripts are significantly ( $P < 0.05$ ) different  
ADFI = Average daily feed intake; ADWG = Average daily weight gain

According to Marai *et al.* (2001), elevated temperature and humidity adversely affects live body weight, daily weight gain and feed intake of growing rabbits. Metabolic activities reduce under extreme environmental conditions. Digestibility coefficient for dry matter, crude protein and crude fibre usually decline in rabbit due to heat stress. New Zealand White rabbit had the highest value for feed efficiency. Apart from the coat pigmentation, the higher values obtained for New Zealand white breed rabbits in this study could also be attributed to their genetic 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 white rabbit and White Satin breed which were also with light pigmentation. The authors reported that the New Zealand White had higher weight gain than Californian, Palomino and White Satin breed. At temperatures above  $21.1^\circ\text{C}$ , the animal's respiration rate begins to increase and increasing amounts of water are lost from the lungs and skin. Increased losses of water signal the animal to consume more water to replace the losses (Harris and VanHorn, 2008) and thus consume and utilize less feed. Mpendulo (2016) also reported a negative relationship between water intake and feed intake of animal.

The effect of sex of animal was significant ( $p < 0.05$ ) on the average feed intake, average weight gain, total weight gain and total feed efficiency of rabbits in this study. The least square means for these parameters presented on Table 2 showed that male rabbits had higher value of average daily feed intake of  $78.44 \pm 3.21$  g compared with their female counterparts with intake of  $74.17 \pm 3.08$  g. Female rabbits had lower average daily weight gain ( $16.49 \pm 0.76$  g) and total weight gain ( $923.34 \pm 47.21$  g) than male rabbits with the average daily weight gain and total weight gain of  $18.79 \pm 0.25$  g and  $1052.37 \pm 54.37$  g, respectively (Table 2). Male rabbits also had better feed efficiency than female rabbits.

**Table 2: Feed intake, weight gain and feed efficiency of rabbits as influenced by sex**

Parameters	Female	Male
ADFI, g	74.17±3.08 <sup>b</sup>	78.44± 3.21 <sup>a</sup>
ADWG, g	16.49±0.76 <sup>b</sup>	18.79± 0.25 <sup>a</sup>
Total Weight gain, g	923.34±47.21 <sup>b</sup>	1052.37±54.37 <sup>a</sup>
Total feed intake, g	4153.52±124.20 <sup>b</sup>	4392.64± 131.50 <sup>a</sup>
Total feed efficiency	0.21±0.01 <sup>b</sup>	0.24±0.01 <sup>a</sup>

<sup>a b</sup> Mean on the same row with different superscripts are significantly ( $P < 0.05$ ) different  
ADFI = Average daily feed intake; ADWG = Average daily weight gain

Superiority of male rabbits to female counterparts with respect to feed intake, weight gain and total feed efficiency in this study could be as a result of hormonal differences between male and female animals and the aggressive feeding behaviour of male animals. Fadare (2014) reported that the rectal temperature, respiratory rate, pulse rate and the heat stress index for male animals is lower than their female counterparts in the humid tropics. Marai and Rashwan (2004) also observed that rabbit does are more susceptible to heat stress than their male counterparts.

The interaction effect of breed and sex was not significant ( $p>0.05$ ) on any of the parameters studied.

### Conclusion

Feed intake and feed efficiency was affected by breed. New Zealand White with light pigmentation had higher values for total feed intake, daily feed consumption and total feed efficiency than other breeds involved in this study in humid tropics. Male rabbit were superior to their female counterparts with respect to feed intake, weight gain and total feed efficiency.

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