BREED EVALUATION OF ANTI-STRESS ON THE BODY WEIGHT AND MORTALITY RATE IN RABBITS

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ABSTRACT
Stress associated with cold and heat on rabbits was investigated. Weaned rabbit of New Zealand White, Chinchilla and Dutch breed were used for the assessments. The body weight, percent mortality rate, meteorological data; temperature and relative humidity were measured. The anti-stress genes considered were glutathione peroxidase, superoxide dismutase and catalase. Data generated were subjected to analysis of variance ANOVA using SAS. The mean average experimental pen temperature ranged from 23.7°C to 32.49°C and relative humidity 12.58 to 73.8%. The glutathione peroxidase 1.89±0.03 and superoxide dismutase 47.82±0.41 were high in New Zealand White. Dutch observed 0.23 percent mortality followed by 0.21 in Chinchilla and 0.16 New Zealand White. Body weight and mortality rate were influenced by glutathione peroxidase and superoxide dismutase in New Zealand White rabbit.
Keywords: Anti-stress, Breed, Body weight, Mortality, Rabbit

INTRODUCTION

The environmental temperature changes below and above the thermal comfort zone of the animals have a negative effect on their performance (Blahova *et al*., 2007). Feed consumption rate is influence by weather and health status of the animal. More feeds and less water are consumed during cold weather in other to meet the heat energy requirement for the body. This is verse versa during the hot weather. Metabolites such as $-O_2$ and ^{-}OH are emit during these processes. However, this influences growth performance of the livestock animals. Cold stress is detrimental to the health of the animal and also has economic implication as farmer incurred more money to feed animals during cold weather. More energy is dissipated as heat and fat accumulation decreased during cold weather (Blahova *et al*., 2007).

During metabolism the body cells produces free radical as by-products that damage biological cells of the body (Abdel-Kalek, 2010). Shortening of life span of red blood cells, cells death, low productivity and mutagenic damage of biomolecules are some of the potential toxic to the body cells produce by reactive oxygen specie (Abdel-Kalek, 2010). Anti-stress such as glutathione peroxidase, superoxide dismutase and catalase play important roles in maintaining the health, productivity and reproductive characteristics of the animals (Spurlock and Savage, 1993).

Rabbit farming is one of fastest income generating venture due to their short gestation length and consume less feed compare to other livestock animals. The meat is low in fat, cholesterol and very good source of protein (Cheeke *et al*., 2000). These features attributed to rabbit make it panacea to protein deficiency in developing countries such as Nigeria (Obike *et al.,* 2010). The phenotypic characteristics such as body size, morphological conformations (shape) and body are important traits in the selection particularly meat and breeder animals (Wu *et al.,* 2008).

MATERIALS AND METHODS

Research Site and Animals

The research was conducted at the Rabbit Unit, Research and Teaching Farm, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University Zaria. The Farm is located in the Northern Guinea Savanna of Nigeria at latitude 11º 09' 06" and longitude 7º 38' 35" (Ovimaps, 2017). The stock comprised of 150 matured rabbits 50 each {New Zealand white (NZW), Chinchilla (CHC) and Dutch (DUT)} were sourced within Zaria environs of Kaduna State, Nigeria. Rabbits were kept in well-ventilated hutch with each individual in a separate hutch. Feed and water were provided *ad libitum*.

Laboratory Analysis

A total of 20 bucks and 20 does from each breed were sampled for the levels of anti-stress gene; glutathione peroxidase (GPx), Superoxide dismutase (SOD) and Catalase (CAT) at 20 weeks of age. Exact 3ml of blood were collected through the ear vein using needle and syringe and transferred to free EDTA (Ethylene Diamine Tetra Acetic acid) bottles. The samples were packed in a container containing ice block and transported to Ahmadu

Bello University Teaching Hospital for the analysis. The samples were then analyzed in serum by enzymatic methods using suitable commercial kits (ELISA kit) by the method of Labib (2010).

Meteorological Data

Environmental readings of pen Ambient Temperature (AT) and Relative Humidity (RH) of the rabbits pen were taken daily at 8.00am and 4:00pm throughout the experimental period. Ambient temperature and relative humidity were measured using wet and dry bulb thermometer (Cocet, Shenzhen=Guangdong, China).

Body Weight

Body weight was carried out using a weighing scale and mortality rate was calculated in percentage.

Statistical Analysis

Data generated for antioxidants in all the breeds were subjected to analysis of variance (ANOVA) using General Linear Model (GLM) procedure of (Duncan, 1955) to test the effects of breed on antioxidants. The significant means were separated using Duncan Multiple Range Test (DMRT) of SAS (2002). The fixed effect model used and shown below:

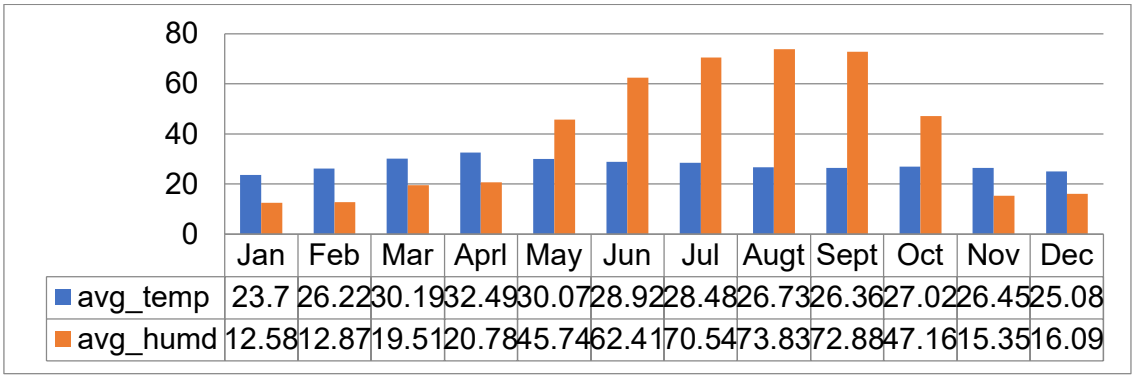
$Y_{ijk} = \mu + G_i + E_{ij}$

Where: Y_{ijk} = Observation on the measurable characteristics, μ = Overall mean, G_i = Effect of i^{th} breeds (New Zealand White, Chinchilla and Dutch) and E_{ij} = Random error.

RESULTS AND DISCUSSION

Temperature and Relative Humidity of the Experimental Pen

The monthly average temperature and relative humidity for the experimental pen are presented in Figure 1. Mean average range of 23.7°C to 32.49°C and 12.58 to 73.8% were observed for tempearature and relative humidity, respectively. However, the month of April had high value of 32.49°C temperature while 73.83% relative humidity in August. The two elements of weather (temperature and relative humidity) observed exceeded the normal upper critical level of 24 - 30°C for domestic rabbits in the tropics established by Willmer *et al*. (2000) and this indicates that rabbit was stressed. This may be responsible for the variation in the estimates recorded here as different animals respond different to weather. The environmental temperature exceeding the upper critical level decrease production and weight loss in rabbits (Villalobos *et al.,* 2008). Although, however observed values of relative humidity here falls within the normal range for rabbit production.



	Jan	Feb	Mar	Aprl	May	Jun	Jul	Augt	Sept	Oct	Nov	Dec
avg_temp	23.7	26.22	30.19	32.49	30.07	28.92	28.48	26.73	26.36	27.02	26.45	25.08
avg_humd	12.58	12.87	19.51	20.78	45.74	62.41	70.54	73.83	72.88	47.16	15.35	16.09

Fig 1: Average temperature and relative humidity of the rabbit pen

Performance of the Rabbits

Table 1 show estimates of anti-stress level on body weight and mortality rate of rabbits. The values obtained for anti-stress, body weight and percentage mortality rate were significantly ($P<0.05$) different between the breed except catalase. New Zealand White (NZW) had high value of 1.89±0.03 and 1650.91±30.81 for glutathione peroxidase (GPx) and body weight, respectively. The values of 48.85±0.44 and 47.82±0.41 for superoxide dismutase (SOD) were high in Dutch (DUC) and NZW rabbit. Percentage mortality rate were 0.23 (DUC), 0.21 (NZW) and 0.16 in Chinchilla rabbit. The performance of livestock animals depend on genetic, nutritional and the environment. Environmental stressor such as cold and heat stress exerts significant effect on the performance of the livestock animals. The synergy of anti-stress defense mechanism of glutathione peroxidase and superoxide dismutase in New Zealand White could be responsible for the higher body weight observed here which also attributed for low percent mortality rate in the breed. Breed variations in the antioxidant genes coding for the superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) enzymes may lead to decreased or impaired regulation of their enzymatic activity and alter reactive oxygen species (ROS) detoxification (Forsberg *et al.,* 2001). Mézes *et al*. (2003) also reported glutathione peroxidase variation in breeds of Goosling were 1.47±0.45 in Hungarian White and 8.72±1.85 in Landes. Willmer *et al.* (2000) attributed variation on the performance of rabbit to exposure to high ambient temperature, humidity, low wind speed, and high direct and indirect solar radiation resulted to heat stress, and exerts adverse effects on animal health, growth, production and

overall performance (Ayo *et al.,* 2011). Activation of vital genes such as glutathione peroxidase, superoxide dismutase and catalase during cold and heat stress helps in the detoxification of oxidants in the body. These anti-stress levels were weak expressed in Dutch and Chinchilla breed and this could be responsible for the higher mortality rate. This also suggests that the breeds were subjected to heat stress as temperature observed here was above the upper critical range for rabbit in the tropics recommended by Willmer *et al*. (2000).

Table 1: Estimate of anti-stress level on body weight and mortality rate of rabbits

	Anti-Stress (u/g)				
Breed	**GPx**	**SOD**	**CAT**	**Body Weight (kg)**	**% Mortality rate**
NZW	1.89±0.03^{a}	47.82±0.41^{ab}	45.66±0.41	1650.91±30.81^{a}	0.16
CHC	1.71±0.03^{b}	47.26±0.43^{b}	44.38±0.41	1526.42±37.94^{b}	0.21
DUC	1.68±0.03^{b}	48.85±0.44^{a}	45.04±0.41	1378.89±31.45^{c}	0.23

Means with different superscripts on the same column are significantly (P<0.05) different. NZW=New Zealand white, CHC=Chinchilla, DUC=Dutch, GPx=glutathione peroxidase, SOD=superoxide dismutase, CAT=catalase.

CONCLUSION

The synergy of the antioxidant such as glutathione peroxidase, superoxide dismutase and potentiality of reactive oxygen specie with genetic material, the variation in genes coding for anti-stress enzymes among individuals or breed play a significant role in growth performance and maintaining the animal genome's integrity. These scavenging abilities of the New Zealand White stand more chances of withstanding heat and cold stress in the tropics as higher body weight and low mortality rate was noted in the breed.

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