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EVALUATION OF THERMOREGULATORY MECHANISMS FOR HEAT TOLERANCE OF HETEROGENEOUS RABBIT POPULATION RAISED IN NIGERIA

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ABSTRACT

The study was conducted to assess thermoregulatory mechanisms of heterogeneous rabbit population for heat tolerance. Data were collected on two hundred eighty-eight adult heterogeneous rabbit population on their physiological traits such as rectal temperature, respiratory rate and pulse rate. Data were also collected on ambient temperature and relative humidity which were used to estimate temperature-humidity index (THI). These data were subjected to both descriptive and correlation analyses using SAS (2004). Result revealed that there were high and positive relationship between THI and physiological traits of these rabbits. Based on the result of this study, it was concluded that the relationship between THI and physiological traits of heterogeneous rabbits was high and positive. Similarly there was high and positive relationship between all the physiological traits considered in this study. Thus, these traits are perceived as thermoregulatory mechanisms for rabbits at high ambient temperature and relative humidity.

Keywords: Heat, heterogeneous, physiology, rabbit, traits

INTRODUCTION

In many developing countries rabbits are reared purposely to achieve animal protein self-sufficiency for the household (Osei *et al.,* 2012). Rabbit meat is nutritious, high in protein, and low in fat and cholesterol (Cheeke *et al.,* 2000). These qualities make rabbit production the panacea to animal protein deficiency in developing countries (Obike *et al.,* 2010). In Nigeria, rabbit production is largely a traditional, non-commercially-oriented, family consumption- targeted and smallholder –type operation comprising an average of 2-7 does and 3 bucks (Abu *et al*., 2008; Oseni *et al*., 2008). The prevalent rabbit stocks in many developing countries in Sub-Saharan Africa including Nigeria are predominantly heterogeneous or composite rabbits described by Lukefahr (1998) as a non-standard breed of rabbits. Lukefahr (2000) noted that a high degree of heterozygosity (inherent in such populations) might be important for fitness-related characteristics (e.g. fertility and survival) as a means for eventual local adaptation.

Rabbit production in tropical and subtropical areas of the world are faced with many problems related to hot climate, particularly heat stress (Marai *et al*., 1991). Climatic conditions in these regions are such that the warm hot season is relatively long, with intense radiant energy for an extended period of time, accompanied with high relative humidity. The temperature and moisture of air are the two major environmental factors controlling the heat stress of livestock (Bouraoui *et al*., 2002; St-Pierre *et al*., 2003). A THI is commonly used as an environmental factor to predict production losses of an animal exposed to hot and humid climatic conditions (Karaman *et al*., (2007).

Thus this study sought to evaluate relationship between temperature-humidity index and physiological traits of heterogeneous rabbit population raised in Nigeria.

MATERIALS AND METHODS

The study was conducted at the Rabbit Unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Nigeria (Latitude 07^0 28' N and Longitude 04^0 33' E). Two hundred and eighty-eight adult heterogeneous rabbits were used for this study. Temperature and relative humidity in the rabbitry were recorded with use of thermohygrometer, this was used to estimate temperature-humidity index as reported by Marai *et al.*, (2001) with the following equation:THI = t – [(0.31 - 0.31(RH / 100)) (t – 14.4)] where: t = air temperature (^{0}C) and RH = relative humidity (%.).

Physiological traits of the rabbits such as rectal temperature, respiratory rate and pulse rate were taken on each animal. These physiological parameters were measured two times a week to avoid undue stress to the animals. The rectal temperature was measured using a digital rectal thermometer inserted into the rectum and left in position till the reading was taken. Respiration rate was recorded as the number of frequency of flank movements per 20 seconds and was calculated as breathes / minute (Thwaites *et al.*, 1990). Pulse rate was also recorded as beats per seconds by placing the stethoscope on the thigh of the rabbits to determine the rhythmic beats of the heart which was later calculated as beats / minute (Thwaites *et al.*, 1990).

Data were subjected to descriptive statistics and correlation analysis using SAS (2004).

RESULTS AND DISCUSSION

Table 1 shows the summary statistics of physiological traits of heterogeneous rabbits population and temperature-humidity index. Result revealed mean of 98.82 ± 17.52 breathes/min for respiratory rate of the rabbits, 39.75 ± 0.82^{0}C for respiratory rate, 106.69 ± 19.14 beats/min and 30.41 ± 10.35 for THI. This result indicated that these rabbits were within the comfort zone and were thermally stressed as reported by Fayez *et al.* (1994); Marai *et al.* (2002). These authors reported 32^{0}C, 137 beats/min, 85 breathes/min and 28.9 -30 for rectal temperature, pulse rate, respiratory rate and THI respectively as comfort limits of heat tolerance and heat stress index for rabbits. This implies that these hereterogenous rabbits are thermally stressed since they have exceeded the values reported by these authors for comfort zones.

Table 1: Summary statitstics of physiological traits of the rabbits and temperature-humidity index

Variables	Mean	Standard deviation	Range
RR (breathes/min)	98.82	17.52	74.00
RT (^{0}C)	33.75	0.82	4.90
PR (beats/min)	146.69	19.14	92.00
THI	29.41	10.35	61.49

Table 2 shows correlation between physiological traits of heterogneous rabbits and THI. Result revealed that there were high, positive and significant ($p<0.05$) relationship between respiratory rates, pulse rate, rectal temperature of the rabbits and THI. This implies that as the THI increases, the physiological traits of the rabbits will also increase. In a similar study conducted on dairy cattle, Bouraoui *et al.*, (2002) reported that THI increased rectal temperature 5^{o}C, heart rate by 6 beats and respiration rate by 5 inspirations per minute of lactating Friesian-Holstein. THI is as shown in Fig 1. is commonly used as an environmental factor to predict production losses of an animal exposed to hot and humid climatic

conditions (Karaman *et al.*, 2007). Result further revealed high, positive and significant ($p<0.05$) relationship between rectal temperature, pulse rate and respiratory rates;which implies that increase in any of the physiological traits of the rabbits will lead to increase in the other physiological traits.

Table 2: Correlation between physiological traits of heterogeneous rabbits and temperature humidity index

Variables	THI	RT(^{0}C)	PR (beats/min)	RR (breathes/min)
THI	1.00	0.42	0.42	0.45
RT (^{0}C)		1.00	0.55	0.70
PR (beats/min)			1.00	0.70
THI				1.00

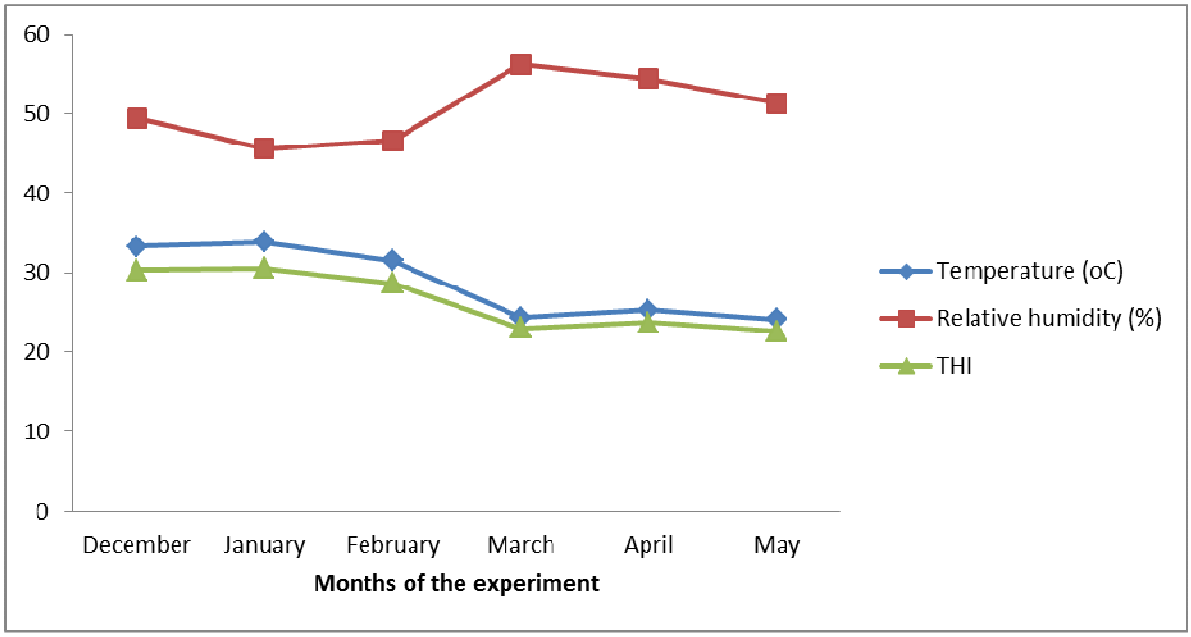

Figure 1. Temperature, relative humidity and temperature-humidity index of experimental environment

CONCLUSION

Based on the result of this study, it was concluded that the relationship between THI and physiological traits of heterogeneous rabbits (rectal temperature, respiratory rate and pulse rate) has high and positive. Similarly there was high and positive relationship between all the physiological traits considered in this study. Thus, these traits, are perceived as thermoregulatory mechanisms for rabbits at high ambient temperature and relative humidity.

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