



RESEARCH ARTICLE

Doe Fertility and Weaning Survival Rate of Composite Rabbits as Affected by Thermal Environment in the Humid Tropical Climate of Southwestern Nigeria

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ABSTRACT

The relationship between doe fertility, pre-weaning survival rate of composite rabbits and temperature humidity index (THI) was evaluated. The study was carried out at the Rabbit Unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Nigeria, during rainy and dry seasons. Data were collected on ambient temperature and relative humidity conditions over the two seasons. The THI was calculated from the climatic records. The rabbits were fed *ad-libitum* and they had access to water throughout the period of the experiment. Amount of feed consumed and weight gained by each rabbit were measured weekly. Service number of pregnancy of doe and pre-weaning survival rate parameters were affected by increase in THI, and were found to vary at different thermal comfort levels. High values of the THI were associated with increase in service number of pregnancy while high THI values were associated with low survival rates of the weaners. Thus, the THI adversely affected doe fertility and kit survival rates.

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INTRODUCTION

Under humid tropical climatic conditions, high temperature and relative humidity are major environmental factors that result in heat stress which influences the productivity and physiological development of animals. In such an environment, rabbits are susceptible to heat stress (McNitt *et al.*, 2000). In Nigeria, rabbit rearing is mainly based on the use of local population which needs a better knowledge of its biological capabilities as well as adaptability to the rearing and environmental conditions. Most of the stocks of rabbits used in developing countries including Nigeria are heterogeneous resulting from years of planned and unplanned crosses among different exotic and/ or indigenous breeds of rabbits introduced to most developing nations (Somade and Adesina, 1990; Odubote *et al.*, 1995). In this regard, there is need to identify the productivity potential of these stocks of rabbit. Reproductive performance of rabbit does, growth rate as well as mortality are the factors that define the productivity potential of rabbit (Rebollar *et al.*, 2009). The feeling of warmth under hot ambient temperature increases with high relative humidity, although the

temperature is interrelated with other climatic factors. Such relationship (between ambient temperature and relative humidity) as was developed by Marai *et al.* (2001) for rabbits as small animals to propose a measurement of the level of severity of heat stress by combining temperature and relative humidity in an index called the temperature-humidity index (THI), to account for the thermal comfort or distress (Finzi *et al.*, 1994). The present study was conducted to assess the relationship between THI and service number of pregnancy of heterogeneous rabbit doe and weaning survival rate of heterogeneous rabbit composite population of rabbits reared in South-western 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^o 28' N and Longitude 04^o 33' E). Based on the records of farm ambient temperature and relative humidity, the whole study period was divided into rain and dry seasons. Temperature and relative humidity in the rabbitry were monitored across seasons (rain and dry) and over day

(diurnal) periods, two to three days apart using dry bulb thermometer and wet and dry hygrometer respectively. As far as possible, these instruments were maintained in an empty cage to provide a record of the temperature and relative humidity experienced by the rabbits. The months of April to October were considered a rainy season period, while the months of November to March were considered the dry season period. Data obtained for temperature and relative humidity were used to develop an index for measuring thermal comfort level of the rabbits. It was measured according to the following equation as developed by Marai *et al.*, (2001): $THI = t - [(0.31 - 0.31(RH / 100)) (t - 14.4)]$ Where: t = air temperature ($^{\circ}C$), and RH = relative humidity (%). A total of eighty-eight rabbits comprising fifty-four does and fifteen bucks were sourced from a heterogeneous population reared in Ibadan, Southwestern Nigeria.

The rabbits were fed commercial diet *ad libitum* and had unlimited access to water. Three does were assigned to a buck, each doe was transferred to the buck's hutch assigned to it for mating. Does were weighed at each mating and on the 14th day of post-coitum, the mated does were palpated for gravid detection; non-gravid does were immediately re-mated, until conception occurred. The matings were done at the cool time of the day (early in the morning and/or late in the evening). Cages of expectant does were provided with kindling boxes as the kindling time drew nearer. The kindling boxes were cleaned and disinfected before placing them into the cages on the 25th day of gestation. At kindling, litters were examined for any dead kits at birth. Live litters were weighed and individual kit weight was recorded within 24 hours of kindling. Fryers were weaned at 42 days of age. Weaners were identified by marking their ears with indelible markers, weighed and housed in wire hutches. Litters of rabbit of nearly similar age categories were housed in a hutch. Records on service number of pregnancy (for the doe) and number of dead kits before weaning were evaluated. Data concerning service number of pregnancy of doe and weaning survival rate of the animals were statistically analysed using the statistical analysis system procedure (SAS, 2004). Two-way analysis of variance (ANOVA) was performed to compare variations in SNP and WSR with THI where significance was indicated, Duncan's Multiple Range test was used to separate the means.

RESULTS AND DISCUSSION

The results (Table 1) showed that at higher THI value, WSR was lower while SNP was higher. When THI value was less than 23, there existed a more comfortable environment for the rabbits than those of corresponding THI values (23-28.3, 28.3-31.4, and >31.4, respectively).

Effects of THI on weaning survival rate

The result of ANOVA for rabbit showed that weaning survival rate was significantly ($P < 0.001$) affected by THI (Table 2). Duncan's Multiple Range test for weaning survival rate (Table 3) showed that at THI 23 and 23-28.3, weaning survival rates of the rabbit were 4.24 and 9.64 higher than when values of THI were 28.3- 31.4 and >31.4 respectively. From Table 1 and Duncan Multiple

Range test, differences in the weaning survival rate was such that the survival rate decreases with corresponding increase in THI value. This result agreed with the findings of Marai and Rashwan, (2003) who reported increase in pre and post-weaning mortalities of rabbits when exposed to heat stress. Yingkai and Mingrong, (2008) also reported decrease in weaning survival rate of rabbits in high temperature season.

Table 1: Mean values of THI, weaning survival rate and service number of pregnancy as affected by seasons.

THI	Weaning survival rate (%)	Service number of pregnancy
< 23	32.53 (1.05)*	24.87 (2.89)
23 – 28.3	27.60 (0.76)	26.44 (3.17)
28.3 – 31.4	23.36 (0.81)	28.70 (2.80)
> 31.4	22.89 (0.96)	31.60(2.42)

*Figures in parentheses are standard deviations

Table 2: Univariate analysis of variance of preweaning survival rate of heterogeneous rabbit with THI

Source of variation	Sum of Squares	Degree of freedom	Mean Square	F- ratio	Sig. Level
Model	367.199	16	22.950	1.436	<0.0001
Intercept	25894.340	1	25894.340	1620.424	<0.0001
WSR	367.199	16	22.950	1.436	<0.0001
Error	974.779	61	15.980		
Total (Corr.)	1341.977	77			

0 Missing values have been excluded

Table 3: Multiple range analysis for preweaning survival rate (Alpha = 0.05)

Duncan grouping	Mean	Number of animals	THI
A	32.53	29	< 23
A	27.60	10	23 – 28.3
B	23.36	21	28.3–31.4
B	22.89	18	> 31.4

Means with the same letter are not significantly different.

Table 4: Univariate analysis of variance of service number of pregnancy of heterogeneous rabbit population with THI

Source of variation	Sum Squares	Degree of freedom	Mean square	F-ratio	Sig. Level
Corrected Model	399.306	3	133.102	10.449	0.000
Intercept	13264.605	1	13264.605	1041.276	0.000
SNP	399.306	3	133.102	10.449	0.000
Error	942.671	74	12.739		
Total (Corr.)	1341.977	77			

0 Missing values have been excluded

Table 5: Multiple range analysis for service number of pregnancy of heterogeneous rabbit population with THI (Alpha = 0.05)

Duncan grouping	Mean	Number of animals	THI
A	24.868	50	< 23
B	28.702	24	23 – 28.3
BC	31.600	2	28.3 – 31.4
C	33.500	2	> 31.4

Means with the same letter are not significantly different.

Effects of THI on service number of pregnancy

The result of ANOVA for rabbit showed that service number of pregnancy was significantly ($P < 0.001$) affected by THI (Table 4). Duncan's Multiple Range test for service number of pregnancy (Table 5) showed that at THI 23 and 23- 28.3, service number of pregnancy of the does were 4.24 and 9.64 higher than when values of THI

were 28.3- 31.4 and >31.4 respectively. In Table 1 and Duncan Multiple Range test (Table 4), there were observed differences in service number of pregnancy, such that there was increase in service number of pregnancy with corresponding increase in THI value. Similar findings were made by Popoola and Oseni (2012) as well as Marai and Rashwan (2003) who reported increase in conception rate of does in heat stressed rabbits. On the other hand Tuma et al., (2010) who reported a significantly higher service number of pregnancy during winter months than during other months of the season.

Conclusion

Results from this study showed that the humid tropical climate of the Southwestern Nigeria produced higher THI that gave a high level of heat stress for heterogeneous rabbits raised in the region. The weaning survival rate and service number of pregnancy of the rabbits were both in accordance with the results of past works. The animals were affected when exposed to heat stress with respect to weaning survival rate and service number of pregnancy both of which are parameters of doe fertility. However, the heterogeneous rabbits used for this study still performed favourably well within the thermal comfort zone range defined by THI.

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