



EFFECT OF ENVIRONMENTAL STRESS ON THE GROWTH PERFORMANCE OF NEW ZEALAND WHITE RABBITS

Biya Ann Joseph¹, Joseph Mathew² and Sabin George³

Department of Livestock Production Management
College of Veterinary and Animal Sciences,
Mannuthy-68-651, Thrissur, Kerala.

Received: 25.01.2014

Accepted: 06.05.2014

Abstract

The most obvious limitation to rabbit production in tropical countries is that rabbits are susceptible to heat stress. A study was conducted at Rabbit Breeding Station, Mannuthy to assess the effect of environmental stress on the growth performance of New Zealand White rabbit kits reared under different experimental groups, in three seasons predominant to the region, namely monsoon, post-monsoon and summer. The treatment groups were T1, T2, T3 and T4. Rabbits in the T1 group were reared in conventional shed and pan watered. Rabbits in T2 were provided with pedestal fans and nipple watering system. Shed of T3 rabbits were improvised with false ceiling and adjustable shades. Those under the T4 group were given a composite treatment of all the above. The Temperature –Humidity Index and growth performance of the rabbits in each season under each treatment were compared. It was observed that the average weight at birth of rabbit kits was non-significant between treatments in all seasons. However, significant difference was observed in weight at weaning and post-weaning. T1 and T4 recorded the lowest and highest weight, respectively. The results on season confirmed that post-monsoon season was most favourable for rabbit production.

Key words: *New Zealand White rabbit kits, environmental stress, temperature –humidity index, growth performance.*

Rabbit farming has immense potential to improve the socio-economic status of the rural poor. The most obvious limitation to rabbit production in tropical countries is that rabbits are susceptible to heat stress. The humid tropical climate of Kerala, contributes substantial stress on temperate breeds of rabbits that adversely affect their performance. Nandakumar (1995) observed that under humid climate of Kerala, exotic breeds like Soviet Chinchilla and New Zealand White had suboptimal growth and reproduction. Hence the present study is envisaged to monitor the environmental stress factors affecting the performance of rabbits and to suggest some ameliorative techniques to reduce the environmental stress.

Materials and Methods

The study was conducted at the Rabbit Breeding Station, Mannuthy to assess the effect of environmental stress on the growth performance of New Zealand White (NZW) rabbits reared under different treatments, in three seasons predominant to the region, namely monsoon (June-September), post-monsoon (October-January) and summer (February-May). Twenty eight NZW rabbits were divided into four groups of seven animals each and allotted to one of the four treatments. Rabbits in the T1 group were reared in conventional shed and pan watered. Rabbits in T2 were provided with pedestal fans and nipple watering system.

1. Assistant Professor, Corresponding author - biya.leon@gmail.com

2. Registrar, KVASU, Pookode, Wayanad

3. Assistant Professor

Shed of T3 rabbits was improvised with false ceiling and adjustable shades. Rabbits under the T4 group were given a composite treatment of all the above.

Temperature-Humidity Index (THI) - Dry bulb temperature ($^{\circ}\text{C}$) and relative humidity (%) were recorded at the hottest part of the day (mid-day) in all the treatment groups. Season wise THI was calculated using the equation proposed by Marai *et al.* (2001):

$$\text{THI} = \text{db}^{\circ}\text{C} - [(0.31 - 0.31 \text{ RH}) (\text{db}^{\circ}\text{C} - 14.4)]$$

Where, $\text{db}^{\circ}\text{C}$ = dry bulb temperature in Celsius; RH = relative humidity percentage/100.

The values obtained were then classified as follows:

<27.8 = absence of heat stress

27.8 – 28.9 = moderate heat stress

28.9 – 30.0 = severe heat stress and

≥ 30.0 = very severe heat stress

Growth performance: The growth rates of kits were obtained by weighing the progenies of rabbits reared under different experimental groups, at weekly intervals before feeding using a standard weighing balance with 5g accuracy.

Results and Discussion

Temperature-Humidity Index

The THI within the shed in each season is shown in Table 1. There was significant difference between seasons in each treatment but the treatments did not differ significantly in each season. However, numerical variation showed that T1 had the highest THI in all seasons as it was the control and was not provided with any of the ameliorative measures to counter the heat and humidity. THI gradually reduced with each treatment resulting in T4 having the lowest THI. Rainy and post-monsoon seasons were found to be stress free but summer was stressful for the animals especially in T1, T2 and T3 groups. This was in agreement with Habeeb *et al.* (1997) and Marai *et al.* (1999) who reported that THI values indicated an absence of heat stress in the mild climate and severe heat stress in the hot climate. T4 had THI value in the stress free range throughout the year, which could be due to the provision of a composite treatment in that group.

Growth performance

Average growth performance of individual

NZW rabbit kits in rainy, post-monsoon and summer seasons are furnished in Tables 2 to 4. The weaning weight observed in the different treatment groups from T1 to T4 in the rainy season were 428.90, 449.50, 468 and 538.78 g, respectively; in the post-monsoon season were 447, 495, 520.50 and 599 g, respectively and in summer season 451, 488.12, 503.75 and 521.71 g, respectively. An increase in weight was observed with each treatment group. T1 and T4 had the lowest and the highest weights, respectively. Hassanein (1980) reported that the lowest body weight was recorded in rabbits under high air temperature as compared to low air temperature which holds true in the present study as T1 was exposed to higher air temperatures than other treatment groups provided with various stress ameliorative measures. Gupta *et al.* (1995) reported that Russian Angora rabbits in semi-arid tropics gave an average individual body weight of 536g at 6 weeks which was similar to the values obtained in T4. T1 being the control was exposed to all the extremes of climate. But rest of the treatment groups had some innovative management techniques to increase the comfort level of rabbits even in adverse climate. Hence T4 which had the composite treatment proved to be the best as the THI value which is an indicator of stress was in the stress free (< 27.8) level as compared to other treatment groups. Due to the comfortable environment provided, T4 seemed to have an increased growth rate. This view was supported by Abd El-Moty *et al.* (1991). According to Chiericato *et al.* (1994) lower thermal levels induced a marked variation on the productive performance of the animals which, due to an increased need for thermogenesis and greater adipogenesis presented higher daily gain and final live weight, which could be the physiological reason for increased body weight in the composite treatment group (T4).

El-Maghawry *et al.* (1999) opined that seasons of kindling had significant ($P < 0.01$) effect on post-weaning individual weights. Post-monsoon season had the highest growth performance among seasons. The possible reason for such a result could be that the micro-environment was conducive for their comfortable living which could have increased its production potential. Also since post-monsoon had the second parity, the rabbit does would be more experienced in caring for their young. The milk

production could have also increased with parity. As Kumar *et al.* (2005) opined, the increase in day length, a comfortable temperature and the availability of a good roughage supply may have contributed to the high growth efficiency of rabbits. Rainy season showed less growth performance which could be due to the lack of experience in rearing the kits as it was its first parity. Summer season though having the third parity had a lower growth performance than post-monsoon which could be due to the increase in the THI level which indicated that summer season was stressful for the rabbits. Azoz and El-Kholy (2006) suggested similar reasons and reported that lower growth in hot conditions may be attributed to the effect of this environmental condition on mothering ability and milk production as a result of hyperthermia. But in the present study, summer season had better growth performance than rainy season possibly due to the rearing experience of the does.

From the results of the study, it can be inferred that provision of stress alleviating

measures in T2, T3 and T4 showed a positive influence on growth as compared to the control (T1). Among these treatments T4 which was given a composite treatment emerged with the best results. The second best seemed to be T3 which was provided with shades and false ceiling. Though T2 which was provided with pedestal fans and nipple watering fared better than the control, it was comparable to T1 in some cases. These results help us to conclude that providing shades and false ceiling was far superior to the provision of fans and nipple watering though a composite treatment as in T4 gave the best results. Post-monsoon season also recorded the highest growth rate as compared to rainy and summer seasons.

References

- Abd El-Moty, A.K.I., Abd El Hakeam, A.A. and Abd El- Rahman, A.M.Z. 1991. Physiological responses of rabbits to high air temperature – Productive and reproductive efficiency. *Egypt. J. Rabbit Sci.* 1: 146-158.

Table 1. Temperature-Humidity Index inside the shed

Season	T1	T2	T3	T4
Rainy	26.06 ^a ±1.11	25.88 ^a ±1.11	25.59 ^a ±1.00	25.42 ^a ±1.01
Post-monsoon	26.42 ^a ±1.88	26.28 ^a ±1.90	25.90 ^a ±1.72	25.58 ^a ±1.71
Summer	28.71 ^b ±1.96	28.48 ^b ±2.01	27.98 ^b ±1.62	27.79 ^b ±1.58

Values (Mean±SD) bearing different superscript in a column differ significantly
Values are non-significant between treatments in each season

Table 2. Growth rate of New Zealand White rabbit kits in rainy season, g

Weeks	T1	T2	T3	T4
Birth	45.75±1.21	47.61±1.88	47.97±1.38	45.10±1.74
1 st	95.67±2.93	110.30±6.60	89.80±4.28	111.11±4.31
2 nd	136.67 ^a ±5.57	150.63 ^a ±6.93	137.00 ^a ±7.21	206.11 ^b ±13.99
3 rd	183.81 ^a ±10.34	207.00 ^a ±11.72	189.17 ^a ±12.78	282.78 ^b ±12.36
4 th	267.75 ^a ±12.51	273.33 ^a ±13.22	282.50 ^a ±16.53	382.22 ^b ±16.58
5 th	333.16 ^a ±13.57	356.43 ^a ±18.71	362.81 ^a ±20.20	472.22 ^b ±17.48
Weaning	428.90 ^a ±13.34	449.50 ^a ±21.65	468.00 ^a ±19.79	538.78 ^b ±19.74
Post-weaning	582.56±13.50	592.50±20.63	586.67±16.01	601.22±22.55

Mean values bearing different superscript in a row differ significantly (P≤0.05)

Table 3. Growth rate of New Zealand White rabbit kits in post-monsoon, g

Weeks	T1	T2	T3	T4
Birth	43.10±0.79	43.97±1.28	44.03±1.35	45.25±1.21
1 st	104.04±4.67	98.82±4.28	90.54±2.74	104.71±6.67
2 nd	164.79 ^a ±10.15	178.44 ^a ±7.44	171.15 ^a ±6.25	220.50 ^b ±4.97
3 rd	226.14 ^a ±15.07	230.31 ^a ±15.24	264.35 ^a ±7.36	321.50 ^b ±4.77
4 th	315.50 ^a ±19.29	326.25 ^a ±18.68	358.23 ^a ±9.19	434.50 ^b ±11.58
5 th	388.00 ^a ±16.58	420.42 ^{ab} ±20.07	455.75 ^b ±12.30	515.50 ^c ±20.77
Weaning	447.00 ^a ±21.65	495.00 ^{ab} ±21.90	520.50 ^b ±12.36	599.00 ^c ±21.85
Post-weaning	568.00 ^a ±20.40	579.56 ^a ±23.35	644.38 ^b ±13.96	676.50 ^b ±21.86

Mean values bearing different superscript in a row differ significantly ($P \leq 0.05$)

Table 4. Growth rate of New Zealand White rabbit kits in summer, g

Weeks	T1	T2	T3	T4
Birth	43.33±1.35	45.00±1.24	46.76±1.87	44.00±1.13
1 st	90.00±3.90	87.92±4.28	95.83±2.58	107.40±3.71
2 nd	136.45±5.56	166.00±6.18	183.04±4.50	175.00±7.10
3 rd	190.80 ^a ±8.73	222.00 ^a ±16.85	249.25 ^b ±10.25	238.67 ^b ±16.31
4 th	253.75 ^a ±13.23	310.63 ^b ±15.20	327.00 ^b ±13.5	360.55 ^c ±15.58
5 th	330.60 ^a ±16.73	407.50 ^b ±17.68	416.50 ^b ±17.14	455.55 ^c ±14.05
Weaning	451.00 ^a ±25.93	488.12 ^{ab} ±17.28	503.75 ^{ab} ±15.92	521.71 ^b ±16.51
Post-weaning	526.47 ^a ±26.66	591.00 ^b ±18.93	599.56 ^b ±18.71	596.00 ^b ±20.26

Mean values bearing different superscript in a row differ significantly ($P \leq 0.05$)

- Azoz, A.A. and El-Kholy, K.H. 2006. Reproductive performance and blood constituents of V-line and Bauscat female rabbits under middle Egypt conditions. *Egypt. J. Rabbit Sci.* **16**: 139-160.
- Chiericato, G.M., Ravarotto, L. and Rizzi, C. 1994. Study of the metabolic profile of rabbits in relation to two different environmental temperatures. *Wild. Rabbit Sci.* **2**: 153-160.
- El-Maghawry, A.M., Ahmed, S.S., Yamani, K.A. and Radwan, H. 1999. Some reproductive and productive traits of New Zealand White, Rex rabbits and their crosses. *Egypt. J. Rabbit Sci.* **9**: 159-177.
- Gupta, S.C., Gupta, N. and Jain, A. 1995. Adaptability of Russian Angora rabbits in semi arid tropics. *Wild. Rabbit Sci.* **3**: 143-146.
- Habeeb, A.A.M., Marai, I.F.M., El-Maghawry, A.M. and Gad, A.E. 1997. Growth of rabbits as affected by salinity in drinking water under winter and hot summer conditions. *Egypt. J. Rabbit Sci.* **7**: 81-94.
- Hassanein, A.M. 1980. Reproductivity of rabbits under different heat conditions. M.Sc. Thesis., Fac. Agric., Cairo Univ., Egypt. 88p.
- Kumar, D., Singh, U., Bhatt, R.S. and Risam, K.S. 2005. Reproductive efficiency

- of female German Angora rabbits under Indian sub-temperate climatic conditions. *Wild. Rabbit Sci.* **13**: 113 – 122.
- Marai, I.F.M., Ayyat, M.S. and Abdel-Monem, U.M. 2001. Growth performance and Reproductive traits at first parity of New Zealand white female rabbits as affected by heat stress and its alleviation in Egyptian conditions. *Tropical Anim. Health Prod.* **33**: 451-462.
- Marai, I.F.M., Ayyat, M.S., Gabr, A.H. and Abdel-Monem, U.M. 1999. Growth performance, some blood metabolites and carcass traits of New Zealand White broiler rabbits as affected by heat stress and its alleviation, under Egyptian conditions. *Opt. Méd.* **41**: 35-42.
- Nandakumar, P. 1995. Genetic studies on the immune response of broiler rabbits. *Ph.D. thesis*, Kerala Agricultural University, Thrissur, 148p. □