The Indian Journal of Animal Reproduction; 29(1): 99-101; June 2008 **Short Communication**

Effect of heat stress on serum testosterone level in rabbits.

C. S. BAHGA[1] AND M.C. HANDA[2]

Punjab Agricultural University,
Ludhiana -141004

ABSTRACT

Nine Soviet Chinchilla and nine Angora male rabbits aged 16-28 months and weighing 2.73 – 3.68 kg. were divided into three groups of six each. Group I was kept in a pen measuring 5.40x2.80x2.90 m and cooled by a ceiling fan (48"). Group II was kept in the pen having the same dimensions as in Group I but cooled by a ceiling fan and a desert cooler. Group III was kept in a shed having dimensions 25.20x12.80x2.90 m and fitted with 12 fans at a distance of 3.20m from each other. The average ambient temperature in Group I, II and III was 31.61± 0.14; 28.88 ± 0.13 and 31.30 ± 0.17°C , while the corresponding values of relative humidity were 65.98 ± 0.86 ; 78.65 ± 0.83 and 68.03 ± 0.89 per cent . Treatment II provided the most comfortable climatic conditions followed by Treatment III and I. The values of serum testosterone were highest in treatment II (2.62 ± 0.41 ng / ml) followed by treatment III (1.92 ± 0.02 ng/ml) and treatment I (1.25 ± 0.35 ng/ml). It can be concluded that heat stress depresses serum testosterone levels and it may be one of the main factors leading to lower reproductive efficiency in males in summer.

Key Words: Heat stress, Testosterone level, Rabbit

Heat stress adversely affects production and reproduction in the rabbits (Bodnar et al 2000; Marai et al 2001) Few studies to ameliorate heat stress have been conducted in rabbits (Abdel -Samee, 1997). Testosterone is an anabolic gonadal hormone (Kalita and Mahapatra, 1999) and its circulating levels were reduced during heat stress (Boiti et al 1992). Rabbits, both male and female reproduce poorly during heat stress. Impaired gonadal function may be one of the several reasons for this anomaly. Not much information in this regard is available under the Indian conditions. The present investigation was, therefore, planned to study the effect of heat stress and cooling on serum testosterone levels.

The experiment was conducted on 9 Soviet Chinchilla and 9 German Angora males aged 16-28 months and weighing 2.73 and 3.68 kg. from June through September. The animals were randomly divided into three Groups. Each Group consisted of 3 animals of each breed. Group I was kept in a pen measuring 5.40 x 2.80 x 2.90 m, fitted with a ceiling fan (48"). Group II was kept in a similar pen as group I but cooled by a fan and a desert cooler. Group III was kept in the routine managerial conditions at the farm i.e. a large shed having dimensions 25.20x 12.80 x 2.90m and fitted with 12 fans. Each rabbit was kept in a cage measuring 60x45x45cm and fed ad lib on seasonal green forages and pelleted ration having 70 % total digestible nutrients and 18 % digestible crude protein. Towards the end of experimentation, about 5.0ml of blood was collected from each animal by heart puncture and allowed to clot at 4 °C for two hours. Blood sera was separated by centrifugation at 1700 g and frozen at – 20 °C till analysis. Serum testosterone was estimated using an immunoenzymatic assay kit from Equipar, Italy. The data were analyzed for analysis of variance as per Steel and Torrie (1981)

Treatment II provided the most comfortable environmental conditions in terms of lowest ambient temperature (28.88 ± 0.13 °C) compared to treatment III (31.30 ± 0.17°C) and treatment I

[1]Deptt. of Processing & Food Engineering [2]Deptt. of Livestock Production & Management, GADVASU, Ludhiana

(31.61± 0.14 °C). The corresponding values of relative humidity were 78.65 ± 0.83, 68.03 ± 0.89 and 65.98 ± 0.86 percent, respectively. The values of testosterone in Treatment I, II and III were 1.25 ± 0.35; 2.62 ± 0.41 and 1.92 ± 0.02 ng/ml, respectively. It indicates that cooling increased and heat stress depressed the circulating testosterone levels.

Not many reports on the effect of heat stress on reproduction in male rabbits are available. The role of testosterone in the reproductive process in mammals has been discussed. Plasma testosterone levels were correlated with structural parameters in rat testes (Gilabert et al 1996}. In beef bulls, the secretion of testosterone in response to GnRH induced LH release was observed and represented maturation of Leydig cells (Lacrois and Pelletier, 1979: Amann and Walker, 1983). The fertilizing ability of stallion was positively correlated with testosterone/LH quotient (Cordes, 1978). The results in the present investigation are in agreement with Boiti et al (1992) who reported reduced testosterone and triiodothyronine values in the heat stressed rabbits. Similar results were reported in buffalo (El-Shama'a et al (1997) but Stewart and Roser (1988) did not observe such change in stallions. In Rabbits, provision of chilled drinking water reduced the ill effects of heat stress on thyroid, kidney and liver functions and improves reproductive traits (Abdel–Samee, 1997). In human beings, testicular hyperthermia altered spermatogenesis as a result of damage to Sertoli and Leydig cells accompanied by lower capacities for cellular division (Miusset et al 1989), and impaired interaction between Leydig cells and Sertoli cells (Bartlett et al 1987) and decreased spermatozoa output (Mieusset et al 1985).

The reasons for lower testosterone levels caused by heat stress have not been reported in Rabbits but this might be due to depressed metabolic rate (Reddy et al 1998) as depression in plasma thyroid hormone level led to decreased testosterone activity in goats. Another reason may be due to depressed steroidogenic acute regulatory (STAR) protein and transcript levels of steriodogenic enzymes in Leydig cells as reported by Bosmann et al (1996) in mice. In buffalo bulls, the pattern of testosterone secretion is followed by that of LH (Dixit et al 1998) but these needs to be confirmed in rabbits.

It can be concluded that the heat stress reduced the circulatory testosterone levels in rabbits and this may be one of the causes of lowered fertility during summer. Suitable remedial measures like reducing the pen size and microclimatic modification is suggested to ameliorate the problem.

REFERENCES

Abdel-Samee, A.M (1997). Response of New Zealand White rabbits to thermal stress and its amelioration during winter and summer of North Sinai, Egypt .J.Arid Env.,**36** (2):333-342.

Amann, R.P. and Walker, O A.(1983). Changes in pituitary–gonadal axis associated with puberty in Holstein bulls. J. Anim. Sci., **57**:443-442

Bartlett, J.M.S. and Sharpe, R.M. (1987). Effect of local heating of the rat testis on the level of interstitial fluid as a putative paracrine regulator of the Leydig cells and its relationship to changes in Sertoli cell secretory function. J. Reprod. Fertil.,**80**:279.

Bodnar, K., Szendro,Z, Nemeth, E.B., Fiben,C. and Radnai,I. (2000). Comparative evaluation of abnormal spermatozoa in Pannnon White, New Zealand White and Angora rabbit semen. Arch. Tierz., **43**:(5),507-5132.

Boiti,C, Chiericato,G.M., Filotto,U., and Canali, C. (1992). Effect of high environmental temperature on plasma testosterone, cortisol, T3 and T4 levels in the growing rabbit .J.Appl. Rabbit Res.**15** (A): 447-455

Bosmann, H.B. Hales, K.H., Xiangquan,Li., Zhiming,Liu: Stocco,D.M.and Hales, D.B (1996). Acute in vivo inhibition of testosterone by endotoxin parallels loss of steroidogenic acute regulatory (STAR) protein in Leydig cells. Endocrinol. Philadelphia, **137**:4522-4525

Cordes, T. (1998). Relationship between seasonal hormones, seminal characteristics and fertility in stallions. Tierrzt. Hochshule, Hannover, 1998. 133:20

Dixit, V.D., Baljit Singh, Singh, P.; Georgie,G.C., Galhotra,M.M.; Dixit, V.P. and Singh, B. (1998). Circadian and pulsatile variations in plasma level of inhibin, FSH, LH and testosterone in adult Murrah buffalo bulls. Theriogenol. **50**(2):283-292.

El-Shama, I.S, Khattab, R.M, Ibrhim,M.A.R, and Darwish, S.A.(1997). Testicular changes associated with onset of puberty in relation to season of birth in Egyptian buffalo males. Ann.Agri.Sci. Moshtohor, **35**(1),227-241.

Gilabert, E.R., Ruiz, E., Osorio, C. and Ortega, E. (1996). Effect of dietary, zinc deficiency on reproductive function in male rats: biochemical and morph metric parameters. J. Nutr. Biochem., 7(7): 403-407.

Kalita, D.J., and Mahapatra, M. (1999). Serum constituents of black Bengal goat after treatment with testosterone. Indian Vet.J.,**76**: 794-796.

Lacrois, A and Pelletier, J. (1979). Short term variations in plasma LH and testosterone in bull calves from birth to 1 year of age. J. Reprod. Fertil., **55**:81-85

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 under Egyptian conditions. Trop. Amim. Hlth, Prod.,**33**(6): 451-462.

Miusset, R., Bujan, L. Plantavid, M. and Grandjean, H. (1989). Increased levels of serum follicle–stimulating hormone and luteinizing hormone associated with intrinsic testicular hyperthermia in oligospermic infertile men. J. Clin. Endocr. Msetab., **68**: 419-425.

Reddy, I.J, Varshney, V.P., Sanwal, P.C, Agarwal, N. and Pande, J.K. (1998). Effect of induced hypothyroidism on the fertility of male goat Asian-Austr.J.Anim.Sci., **11**(1): 55-59.

Steel, R.G.D and Torrie, J. (1981). Principles and Procedures of Statistics: A biometric approach, 2nd Ed; McGraw–Hill, International Book Agency, Singapore.

Stewart, B .L and Roser, J .F.(1998). Effect of age, season and fertility status on plasma and intratesticular immunoreactive (I.R.) inhibin concentrations in stallions. Domestic Anim.Endocrinol. **15**(2): 129-139.

THE INDIAN JOURNAL OF ANIMAL REPRODUCTION

Editor, Editorial Board is thankful to all distinguished referees who helped us in the evaluation of articles. We request all referees / Editional board members to be quick in evaluating articles for timely publication of the journal.

Editor IJAR