THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
May, 2023; 3(05), 850-852

Popular Article

Effect of heat stress on animal reproduction

Pradeep Chandra[1], Bhagirathi[2], Manish Arya[3], Nancy Jasrotia[1], Tripti Pandey[4]

1. Ph.D. Scholar, Division of Animal Reproduction, ICAR-Indian Veterinary Research Institute, Izatnagar, U.P., 243122
2. Ph.D. Scholar, Division Veterinary Medicine, ICAR-Indian Veterinary Research Institute, Izatnagar, U.P., 243122
3. Ph.D. Scholar, Division of Veterinary Surgery, ICAR-Indian Veterinary Research Institute, Izatnagar, U.P., 243122
4. Ph.D. Scholar, Division of Biological Standardization, ICAR-Indian Veterinary Research Institute, Izatnagar, U.P., 243122

https://doi.org/10.5281/zenodo.7976841

Abstract

An environment that acts to raise body temperature above the set-point temperature is referred as heat stress. During heat stress there is a marked reduction in feed intake by animal which ultimately affects its body condition score and metabolism. In livestock the fertility and reproductive efficiency of the animal is affected by heat stress as it affects normal physiological reproductive processes by various hormonal disorders and causes disturbances in normal spermatogenesis and oocyte development which ultimately resulted in compromised oocyte and spermatozoa quality and decreases conception rate and embryo survival. High environmental temperature also causes a decrease intensity and signs of estrus by disturbing ovarian function in female animals. During heat stress the estradiol secretion and LH pulse frequency is reduced which results in reduced estrous expression of animal. Heat stress also decreases developmental competence of oocytes. Additionally, the maintenance of pregnancy is threatened by the increased release of endometrial PG F_2 alpha during heat stress. In males reared in tropical and subtropical conditions, the testicular temperature increases due to heat stress which is affecting spermatogenesis and semen quality, which leads to reduced bull fertility.

Introduction

Due to stressful condition the hypothalamic-pituitary-adrenal (HPA) axis activates in animals which further releases ACTH hormone. This hormone is responsible for release of glucocorticoids and catecholamines, which have powerful anti-stress effects but ultimately affects follicular

dynamics (recruitment, selection, dominance, and ovulation of follicles). Heat stress eventually affects time of puberty in male and female animals it also reduces the follicular development rate and favors atresia of ovarian follicles. Due to heat stress the preovulatory follicle doesn't attain its maximum size, as we know bigger the size of POF higher the concentration of estradiol and greater the estrus exhibition pattern in animal.

The cyclical activity in females is affected by change in environmental temperature, especially in buffalo incidences of silent estrous are more during summer month than cooler months. In *Bos taurus* cattle also the estrous detection rate was lower during summer months, opposite to this *Bos indicus* breeds reared at subtropics and tropical climatic conditions show no effects of heat stress in estrous incidences. Humidity and harmful radiations emitted from sunlight may affect cyclicity in cattle and buffaloes. The higher temperature damages cell through oxidation and apoptosis and decreases development competency of oocyte. It also alters the protein formation inside oocyte which are essential for development of embryo. It allows follicle to persist for longer times in ovary by delaying LH pulse frequency which ultimately results release of aged oocyte which is not developmentally competent. The damaging effects of higher body temperatures can be seen on growing fertilized ovum and developing embryos during early period of their life and may be responsible for embryonic death and fetal losses. Therefore, multiple physiological mechanisms are affected during heat stress which eventually reduces animal fertility. Now a days heat stress-associated fertility problems are of global concern as we know the environmental temperature is increasing day by day due to effects of global warming. Higher environmental temperature also affects the blood supply to the mother which can lead to abortion during pregnancy. In post partem animals also heat stress affects the feed intake due to which animal comes in negative energy balance, and shows prolong post partem anestrous.

In males the optimum testicular temperature is necessary for spermatozoa production. The testicular temperature can be regulated through thermoregulatory mechanism via (tunica dartos muscle and pampiniform plexus). Heat stress affects the normal spermatogenesis (process of spermatozoa production), hence reduces fertility in males. Further, persistent heat stress may lead to damage seminiferous tubules and sertoli cells and lowers testosterone production, sperm concentration, motility, affects sperm normal morphology which finally results in sub fertility in animals. The heat stress affected bull will show abnormal semen picture, low motility of

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published **23.05.2023**

spermatozoa, higher percentage of abnormal spermatozoa, higher percentage of cytoplasmic droplets in ejaculates and low post thaw motility.

Conclusion

The effects of heat stress on livestock can be reduced by implementing appropriate scientific measures, such as physical environment modification, dietary control, and breed development of cattle that are less sensitive to heat stress and increasing use of *Bos indicus* or native breeds which are already acclimatized in environmental conditions and genetic selection of heat tolerant breed. Additionally, modern reproductive methods like hormone therapy, timed artificial insemination (AI), and embryo transfer technology can be used to combat summer infertility due to heat stress. These techniques may increase the likelihood that farm animals will become pregnant and increases farmers income. During summer season, the stress due to environmental temperature in the shed can be reduced by providing adequate housing space, adlibitum water to animal, water sprinklers can be used to give cooling effect to animals, for economically good farms summer coolers can also be installed to counter heat stress. The animal should be allowed to grazing during early morning and evening hours to reduce heat stress.

References

Al-Katanani YM, Paula-Lopes FF, Hansen PJ. Effect of season and exposure to heat stress on oocyte competence in Holstein cows. Journal of Dairy Science. 2002; 85:390-396

Chebel RC, Santos JEP, Reynolds JP, Cerri RLA, Juchem SO, Overton M. Factor affecting conception rate after artificial insemination and pregnancy loss in lactating dairy cows. Animal Reproduction Science. 2004; 84:239-255

Nardone A, Ronchi B, Lacetera N, Ranieri MS, Bernabucci U. Effects of climate changes on animal production and sustainability of livestock systems. Livestock Science. 2010;130(1):57-69

Singh M, Chaudhari BK, Singh JK, Singh AK, Maurya PK. Effects of thermal load on buffalo reproductive performance during summer season. Journal of Biological Science. 2013;1(1):1-8

Upadhyay RC, Ashutosh, Singh SV. Impactof climate change on reproductive functions of cattle andbuffalo. In: Aggarwal, PK, Editor. Global Climate Change and Indian Agriculture. New Delhi: ICAR; 2009. pp. 107-110

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com

Published **23.05.2023**