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Poor Reproductive Performance Associated with Skin Injuries of the Male Lesser Mouse Deer

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ABSTRACT

Skin injury at the ventral part of the body and joints of hind limbs are common in lesser mouse deer in captivity, especially when kept in unsuitable cages. These animals showed unstable behaviour due to stress that could lead to their inability to mount during mating. The recovery was long due to the constant in-contact of the lesions to the environment. However, recovery can be aided by antibiotic and supportive therapies, which include fluid and nutritional supplementations which can substitute severe fluid and protein losses. Broad spectrum of antibiotic should be used to prevent secondary bacterial infection.

Keywords: Reproductive performance, lesser mouse deer, skin injuries

INTRODUCTION

Extinction of mammalian species is part of the natural process of evolution and is irreversible. However, it is now occurring at a much higher rate because of human activities such as habitat destruction, over-hunting or competition with introduced herbivores (Holt and Pickard, 1999).

Lesser mouse deer (*Tragulus javanicus*), weighing only 1.6 - 2 kg, belong to sub-order Ruminantia. It has been recognized as the smallest ruminant. Native to Southeast Asia, the wild population of lesser mouse-deer has sharply declined due to illegal hunting and habitat changes resulting from developments in logging, mining, shifting agriculture, and other changes in land use. *Tragulus javanicus* is listed in the red list by IUCN.

Dedicated field investigations of status are urgently warranted, and the species Red List status should be reviewed regularly in light of the current uncertainty and concerns. The magnitude of this phenomenon is illustrated by the 2006 Red List launched by the Species Survival Commission (IUCN-World Conservation Union; http://www.iucnredlist.org/). This document catalogues 1,528 animal species reported as critically threatened, including 162 species of mammals. Therefore, conservation and management of lesser mouse deer is particularly important.

The aim of animal conservation is to maintain biodiversity because removal of a single species can affect the function of global ecosystems (Myers *et al*., 2000). Habitat preservation is one of the best ways to conserve biodiversity (Loi *et al*., 2001). Global conservation can be

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achieved through *in situ* and *ex situ* conservation strategies, whereby the *in situ* conservation strategies enable live populations of animals to be maintained in their adaptive environments. However, these efforts are sometimes insufficient for the propagation of small populations or maintaining adequate genetic diversity. Hence, the *ex situ* conservation strategies have been developed, aimed at establishing a viable population through captive breeding and cryo-preservation of animal genetic resources.

One of the major problems with the implementation of *in situ* and *ex situ* conservation programmes is the lack of understanding of reproductive patterns to maximize reproductive efficiency. Lesser mouse deer can give birth once or twice a year. Puberty is reached at the age of 5-6 months while its females have 16 days estrous cycle with 35-48 hours of estrous duration (Kudo *et al.*, 1997).

Previous studies on the male lesser mouse deer revealed that sperm quality, spermatozoa morphology, and histochemical properties affected the reproductive performance (Haron *et al.,* 2000; Agungpriyono *et al.,* 2005). However, investigating the effects of skin injuries on the reproductive performance of the male lesser mouse deer is also necessary. Therefore, the objective of this report is to describe the skin injuries which have been associated with poor reproductive performance of the male lesser mouse deer.

REPRODUCTIVE PERFORMANCE OF MALE LESSER MOUSE DEER

Lesser mouse deer is believed to be one of the most primitive living ruminants (Whittow *et al.,* 1977; Haron, 2000). Male and female lesser mouse deer in captivity usually reach sexual maturity at 5 - 6 month of age (Robin, 1990). However, attempts at natural breeding of lesser mouse deer in captive are still unsuccessful. This may be due to the lack of information about the animal reproductive behaviour (Haron, 2000). The inability to mount during captivity might be one of the factors which resulted in reduced reproductive performance of the male lesser mouse deer because of poor libido, stress or physical trauma. Sexual appetite or libido is controlled by a neuro-hormonal mechanism which can be affected following any changes in the environment (Arthur *et al*., 1989).

Similarly, stress is a force of nature which externally affects the animals (Panzarino, 2008). Earlier, Selye (1956) concluded that stress is a biological term which refers to the consequences of the failure of animal's body to respond appropriately to physical threats, whether actual or imagined. It is the autonomic response to environmental stimulus which includes a state of alarm and adrenaline production, short-term resistance as a coping mechanism and exhaustion.

Lesser mouse deer is easily under stress, shy, and tend to hide. When threatened, lesser mouse deer rapidly beat their hooves on the ground at a speed of up to 7 times per second, creating a drum roll, bump to the wall of cage (Grzimck, 1994).

Observations on the behaviour of the lesser mouse deer during captivity revealed that these animals passed their time by laying down (*Fig. 1*). At day time, they lay down for a total period of more than 6 hours. Therefore, the skin over metatarsal and hock joint of the hind legs and the sternum showed traumatic injury due to pressure (*Figs. 2-3*). This injury usually takes time to recover since the injured areas are in contact with the ground. Furthermore, the position of the injury affects the ability to mount the female.

PATHOGENESIS OF THE INJURY

Trauma is defined as any body wound or shock produced by a sudden physical injury, such as from accident, injury or impact (Kumar *et al.,* 2003). Traumatic injury has been shown to stimulate an immune response manifested both at the sites of the injury and systemically. The production of both pro-inflammatory and immuno-suppressive cytokines leads to the activation of certain peripheral blood leukocytes as compared to the suppression of others, indicating an attempted differential regulation

Fig. 1: A lesser mouse deer in a laying down position during captivity

Fig. 2: Traumatic injury in the form of ulceration (arrow) on the skin of sternum

Fig. 3: Skin injury on the hind legs of a lesser mouse deer (arrow)

of immune cell subsets. Hypothetically, the immune reaction at the site of the trauma benefits recovery from injury, whereas a systemic response to self-antigens released after tissue damage could be harmful (Kumar *et al.,* 2003).

When the epidermis is injured, a complex train of events is initiated and this can lead to either regeneration or repair. Skin damage accelerates cell division in the affected part, but the mechanisms of this response are imperfectly understood. It has been suggested that when a wound hormone is released, it stimulates cell division as it diffuses into the area. Another view is that cell multiplication takes place when the normal inhibitors are removed. These inhibiting substances are called chalones. Under normal circumstances, mitosis in the skin is subjected to a circadian rhythm and it is suggested that cell division is normally held in check by the formation of adrenalin-chalone complexes. After injury, it is believed that the inhibitors diffuse away.

The epidermal cells begin to divide after 12-16 h of injury with rapid bursts of mitotic activity. The epithelium in the injured area spreads beneath the surface clot and bridges the gap in the damaged tissues. This new epithelium may considerably thicken and extend well down into the dermis. Meanwhile, an exudative reaction may occur in the area to enable cells and fluid to be brought into the damaged tissue. After several days, mitosis occurs in the connective tissue elements and some of the infiltrating macrophages change their morphology. Collagen is produced from fibroblasts and vascular elements, whereas fibroblasts and collagen proceed to fill in the gaps in the skin. The down-growths of the epithelium are removed by phagocytic activity. The wound is thus filled-in with granulation tissue covered by epithelium. In the late stages of wound healing, contraction of these new tissues occurs and this results in the formation of scar.

The injury recovery in this animal takes a long time because the skin where the injury occurs is always in-contact with the environment. Furthermore, animals with skin injury over joints show unstable and stressful behaviours which lead to the lack in mounting activity during mating.

DISCUSSION

Matsubayashi *et al*. (2003) reported that lesser mouse deer is a solitary individual with a home range that tends to be larger for males than females. The social system of lesser mouse deer is monogamy but the male lesser mouse deer also can be polygamous.

Lesser mouse deer are mainly active during the day and they rest at night. Darlis *et al*. (2001) reported that male and female lesser mouse deer spent 956 and 896 min/day respectively for laying down, 463 and 520 min/day for standing, and 21 and 24 min/day for eating. For lying down, lesser mouse deer select a suitable floor and tend to use the same place if the cage is limited. Therefore, unsuitable floor surface and urine are found to most frequently cause the skin injury on the hind legs and sternum of the lesser mouse deer. Nevertheless, the floor type in the lying area for pig, however, does not affect the proportion of pigs lying down laterally or sternally, or huddling (Salvary *et al*., 2009).

Skin is an outer part which covers the body. It is the largest organ of the integument system made up of multiple layers of epithelial tissues which guard the underlying muscles, bones, ligaments and internal organs. Following skin injury of the limbs, the superficial digital flexor tendon is frequently injured, while 8.6 % injuries are being bilateral (Dahlgren, 2007). Abrasiveness and hardness of the floor are likely to be the major causes of these lesions (Mouttotou *et al*., 1999; Mayer and Hauser, 2001). Jainudeen and Hafez (2000) revealed that the inability to mount is a common disorder encountered in older bulls and boars associated with locomotors dysfunction which arises from dislocations, fractures, sprains, and osteoarthritis lesion of the hind limbs and vertebrae. Similarly, degenerative changes in the articular surface of the stifle and hock joints and exostoses of the thoraco-lumbar vertebrae interfere with mobility and ability to mount, as observed in lesser mouse deer.

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REFERENCES

Agungpriyono, S., Prasetyaningtyas, W.E., Boediono, A., Yamamoto, Y. and Setiadi, M.A. (2005). Sperm quality and sperm preservation in the lesser mouse deer, *Tragulus javanicus*. *Proceedings of the 9th International Mammalogical Congress,* Sapporo (Japan) July 31-August 5, 2005.

Arthur, G.H., Noakes, D.E. and Pearson, H. (1989). *Veterinary Reproduction and Obstetrics* (6th edn.). Bailliere Tindall, UK.

Dahlgren, L.A. (2007). Pathobiology of tendon and ligament injuries. In *Clinical techniques in equine practice*. Elsevier Saunders.

Darlis, Abdukkah, N., Liang, J.B., Purwanto, B. and Ho, Y.W. (2001). Energy expenditure in relation to activity of lesser mouse deer (*Tragulus javanicus)*. *Comparative Biochemistry and Physiology Part A*, *130*, 751-757.

Grzimck, T. (1994). *Encyclopedia of Mammals*. New York: McGraw-Hill Publishing Company.

Haron, A.W., Yong, M. and Zainuddin, Z.Z. (2000). Evaluation of semen collected by electro ejaculation from captive lesser mouse deer. *Journal of Zoo and Wildlife Medicine*, *31*, 164-167.

Holt, W.V. and Pickard, A.R. (1999). Role of reproductive technologies in genetic resource banks in animal conservation. *Review on Reproduction, 4,* 143-150.

Jainudeen, M.R. and Hafez, B. (2000). Reproductive failure in males. In B. Hafez and E.S.E. Hafez (Eds.), *Reproduction in farm animals* (7th edn.). Lippincott Williams & Wikins. USA.

Kudo, H., Fukuta, K., Imai, S., Dahlan, I., Abdullah, N., Ho, Y.W. and Jalaludin, S. (1997). Establishment of lesser mouse deer (*Tragulus javanicus*) colony for use as a new laboratory animal and/or companion animal. *JIRCAS Journal, 4,* 79-88.

Kumar, V., Contran, R.S. and Robbins, S.L. (2003). *Robbins Basic Pathology* (7th edn.). USA: Saunders.

Loi, P., Ptak, G., Barboni, B., Fulka, J., Cappai, P. and Clinton, M. (2001). Genetic rescue of an endangered mammal by cross-species nuclear transfer using post-mortem somatic cells. *Nature Biotechnology, 19*, 962-964.

Matsubayashi, H., Bosi, E. and Kashima, S. (2003). Activity and habitat use of lesser mouse deer (*Tragulus javanicus*). *Journal Mammal, 84*, 234-242.

Mouttotou, N., Hatchell, F.M. and Green, L.E. (1999). Prevalence and risk factors associated with adventitious burstitis in live growing and finishing pigs in southwest England. *Preventive Veterinary Medicine*, *39*, 39-52.

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B. and Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature, 403*, 853-858.

Panzarino, P.J. (2008). Stress. Retrieved from http:// www.medicinenet.com/ stress/article.htm.

Robin, K. (1990). Chevrotains. In S.P. Parker (Ed.), *Grzimek's Encyclopedia of Mammals, 5*, 120-123. New York: McGraw Hill.

Salvary, P., Gygax, L., Wechler, B. and Hauser, R. (2009). Effect of a synthetic plate in the lying area on lying behaviour, degree of fouling and skin lesions at the leg joints of finishing pigs. *Applied Animal Behaviour Science, 118*, 20-27.

Selye, H. (1956). *The Stress of Life*. New York: McGraw-Hill.

Wittow, G.C., Scammel, C.A., Leong, M. and Rand, D. (1977). Temperature regulation in the smallest ungulate, the lesser mouse deer (*Tragulus javanicus*). *Comparative Biochemistry and Physiology, 56A*, 3-26.