

1990

SHORT COMMUNICATION

OBSERVATIONS ON THE SKELETON OF THE SUMATRAN RHINOCEROS

**SUMMARY:** Observations in the present paper is the result of a study on a Sumatran rhinoceros that died in captivity at Zoo Melaka. The skeleton of the Sumatran rhinoceros is briefly described and compared with the skeleton of the horse. The Sumatran rhinoceros has a higher number of thoracic vertebrae and a lower number of lumbar and sacral vertebrae. In addition, the length of the cervical is about three times shorter than the thoracic vertebrae. This is an adaptation to counter the weight of the large head.

**Key words:** Sumatran rhinoceros, skeleton, *Dicerorhinus sumatrensis sumatrensis*

INTRODUCTION

Rhinoceros belongs to the same order as the tapir (family: Tapiridae) and the horse (family: Equidae). There are five living species of rhinoceros, of which two are found in Africa and three in Asia (Grzimek, 1972). The Sumatran rhinoceros (*Dicerorhinus sumatrensis sumatrensis*) is the smallest of these and is considered to be the most primitive of all the living species of rhinoceros (Walker, 1964; Grooves, 1967; Grzimek, 1972). It has two horns on the nose and carries two permanent folds on the skin (Van Strien, 1974; Medway, 1978).

There is a dearth of information concerning the skeleton of the rhinoceros, in general, and of Sumatran rhinoceros, in particular. The availability of information on the skeleton of the horse allows for a comparative study. The objective of the paper is to describe briefly the skeleton of the Sumatran rhinoceros and compare some of its features with those of the horse.

MATERIALS AND METHODS

An adult male Sumatran rhinoceros was captured in June, 1986 at Torgamba, Indonesia and brought to the Melaka Zoo in April, 1987. On 6th August of the same year, it suffered severe colic resulting in death (Zainal-Zahari *et al.*, 1988).

The skin, meat, fat and tendons were removed from the carcass. The bones were boiled in a commercial detergent for two hours to remove the remaining tissue and then dried. Any excess fat was removed by soaking in the same commercial detergent several times.

The length of the cervical, thoracic, lumbar and sacral vertebrae were obtained by using a vernier calliper (Mitutoyo, Japan).

RESULTS AND DISCUSSION

The skeleton of the Sumatran rhinoceros consists of 265 bones compared to 205 bones in the horse (Sisson and Grossman, 1975). The number of bones in the various segments of the skeleton is given in Table 1.

TABLE 1  
The bones of the various segments of the skeleton of the Sumatran rhinoceros compared to the horse

	Sumatran rhinoceros	Horse*
Vertebral column	60	54
Ribs	40	36
Sternum	1	1
Skull (including auditory ossicles)	34	34
Thoracic limbs (including sesamoids)	64+	34
Pelvic limbs (including sesamoids)	66+	40
Total	265	205

+ estimated number of sesamoids for each limb = 9

\* Sisson and Grossman, 1975

The vertebral column comprises seven cervical, twenty thoracic, three lumbar, four sacral (fused) and twenty-six caudal (coccygeal) vertebrae. Thus its vertebral formula is C<sub>7</sub> T<sub>20</sub> L<sub>3</sub> S<sub>4</sub> Ca<sub>26</sub>, while by comparison, the vertebral formula of the horse is C<sub>7</sub> T<sub>18</sub> L<sub>6</sub> S<sub>5</sub> Ca<sub>15-21</sub>.

The total number of vertebrae in the cervical, thoracic, lumbar and sacral regions in the Sumatran rhinoceros and the horse are 34 and 36, respectively. In the rhinoceros, there has been an increase in the number of thoracic vertebrae and reduction in the lumbar and sacral regions. The measurements of the body lengths of the cervical, thoracic, lumbar and sacral regions are given in Table 2. It is interesting to note that the length of the cervical and thoracic regions comprise 18.03 percent and 63.9 percent of the vertebral column (excluding the caudal vertebrae) in the Sumatran rhinoceros, while the corresponding values are 33.33 percent and 40.95 percent in the horse. The shorter cervical and the longer thoracic regions in the rhinoceros are adaptations to counter the weight of the large head.

TABLE 2  
Lengths of the bodies of the cervical, thoracic, lumbar and sacral regions of the Sumatran rhinoceros and the horse

Region	Sumatran rhinoceros*		Horse**	
	mm	%	mm	%
Cervical	250	18.03	700	33.33
Thoracic	875	63.09	860	40.95
Lumbar	132	9.52	340	16.19
Sacral	130	9.37	200	9.52

\* excluding the intervertebral disc.

\*\* including the intervertebral disc (Sisson and Grossman, 1975).

The vertebral column of mammals form a complicated girder to support the body and facilitate movements (Young, 1975, 1981). Large graziers and browsers that are relatively free from predators need not be agile and the evolutionary trend has been towards a skeleton with graviportal features (Hilderbrand, 1982).

The rhinoceros is the only surviving perissodactyles with a graviportal type of body (Young, 1975, 1981) where the vertebral column carries increased number of ribs, and together with the long thoracic spines forms a beam to support the abdomen and counter balance the weight of the head on the fore limbs. The hind limbs provide the main thrust for locomotion. Such a structural arrangement is more suited for charging rather than for swift movement.

#### ACKNOWLEDGEMENTS

The authors wish to thank the Director-General of the Department of Wildlife and National Parks, West Malaysia, for support and encouragement. We are grateful to the staff of Zoo Melaka and the Faculty of Veterinary Medicine and Animal Sciences, Universiti Pertanian Malaysia for their valuable assistance.

ZAINAL-ZAHARI, Z.,<sup>1</sup> VIDYADARAN, M.K.,<sup>2</sup> MOHD-TAJUDDIN, A.<sup>1</sup>,  
ROZYATI, T.H.<sup>2</sup> and PENG, B.T.<sup>2</sup>

<sup>1</sup>Department of Wildlife and National Parks  
Zoo Melaka, Air Keroh, 75450 Melaka, Malaysia.

<sup>2</sup>Faculty of Veterinary Medicine and Animal Sciences  
Universiti Pertanian Malaysia  
43400 Serdang, Selangor, Malaysia.

#### REFERENCES

- GRZIMEK, B. (1972). Annual Life Encyclopedia Mammals IV. Vol. 13, p 34-70, Van Nostrand Reinhold Co., New York.
- GROOVES (1967). On the Rhinoceros of Southeast Asia. *Sangerak mlt.* 15: 221-237.
- HILDERBRAND, M. (1982). Analysis of Vertebrate Structure. 2nd edn., p 427-483. John Wiley and Sons, New York.
- MEDWAY, L. (1978). The Wild Mammals of Malaya (Peninsular Malaysia) and Singapore. 2nd edn., p 103. Oxford University Press, Kuala Lumpur.
- SISSON and GROSSMAN (1975). The Anatomy of the Domestic Animals. 5th edn., Vol. 1, p 255-266. W.B. Saunders Co., Philadelphia.
- VAN STRIEN, N.J. (1974). The Sumatran or two-horned Asiatic rhinoceros. p 81. Meded. Landbouwhogeschool Wageningen 74-16.
- WALKER, E.P. (1964). Mammals of the World. Vol. 2, p 1352. The John Hopkins Press, Baltimore.
- YOUNG, J.Z. (1975). The Life of Mammals. 2nd edn., p 76-77. Clarendon Press, Oxford.
- YOUNG, J.Z. (1981). The Life of Vertebrates. 3rd edn., p 533-543. Clarendon Press, Oxford.
- ZAINAL-ZAHARI, Z., MOHD-ZAMRI, S and MOHD-TAJUDDIN, A. (1988). Death of a male Sumatran rhinoceros at Zoo Melaka, Malaysia. Unpubl. report. Dept. Wildl and Natl. Parks, Kuala Lumpur, Malaysia.

#### RINGKASAN

##### PEMERHATIAN KE ATAS TULANG RANGKA BADAK SUMATERA

Kertas kerja ini adalah hasil daripada kajian ke atas badak Sumatera yang mati dalam kurungan di Zoo Melaka. Tulang rangka badak Sumatera diterangkan secara ringkas dan dibandingkan dengan tulang rangka kuda. Badak Sumatera mempunyai bilangan tulang belakang torasik yang tinggi dan tulang belakang lumbar dan sakrum yang rendah jika dibandingkan dengan kuda. Tulang belakang torasik adalah 3 kali lebih panjang daripada tulang servikal. Ini adalah sebagai penyesuaian bagi menanggung berat kepala yang besar.