# Numerical Variation of the Sacral Segments in the Donkey *( Equus acinus )**

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## Abstract

After ending of the dissection lessons for the students in faculties of Veterinary Medicine in both Assiut and Menoufiya Universities, 130 macerated specimens of the donkey sacra were collected, cleaned and examined. Sacra with 4, 4½, 5, as well as 6 sacral foramina were identified.

This finding in the donkey is described and discussed with other equidae species. The results were supported by one table and five figures.

## Key Words

Sacrum, Donkey, Sacral Foramina.

## Introduction

Along the course of examining the donkeys vertebral column in the dissecting room in faculties of Veterinary Medicine, Assiut and Menoufiya Universities, EGYPT, I observed some anatomical differences concerning the number of the sacral vertebrae and the intervertebral foramina in between. This observation led to the idea of reporting it . This observation my be of interest for the morphologists as well as the teratologists. On the other hand, may provide background information desirable for further studies on ankylosing diseases of the spines of the donkey.

It is well known in all veterinary textbooks of anatomy that the sacrum of horses and their relatives in the genus Equus is formed by fusion of five vertebrae, and is conveniently described as a single bone (Sisson and Grossman, 1963). Nickel et al. (1986) mentioned that the number of the fused vertebrae in man, goat, ox, and horse -5; sheep-4;(occasionally 3 or 5); pig-4; carnivores-3 .Moreover, the same authors added that fusion of the os sacrum in man takes place between 16-30 years of age. In carnivores and pigs it is complete in 1½ years, in ruminants in 3-4 years and in horses from 4-5 years of age. In camels the fifth segment often does not fuse with the fourth one and several investigators include only the four constantly fused segments in their description of the camel sacrum ( Smuts and Bezuidenhout, 1987)

## Material and Methods

The 10 % formalin preserved donkeys used for the students in the practical lessons in Faculty of Veterinary Medicine in both Assiut and Menoufiya Universities were used in this study. A total number of 130 secra ( table 1 ) were collected, cleaned and examined. The donkey specimens were all above three years of age and were of both sexes. They were physically healthy and not complaining any type of lameness.

* Part of a Ph.D. thesis (in surgery) prepared by the author.

| Site | Time | Number |
|---|---|---|
| Dissecting room in Fac. Vet. Med. Assiut University | **1992-1997** | **90** |
| Dissecting room in Fac. Vet. Med. Menoufiya University | **1999-2002** | **40** |

Table (1) : Material of the work. Site and time of collection

## Results and Discussion

In the macerated specimens of the donkey vertebrae, sacra with fused four , five and six vertebrae were identified. These vertebrae have 3, 4, 5 sacral foramina in-between respectively **(Figs, 1-3)**. Moreover, sacra with 4½ vertebrae were also seen **( Fig. 4)** .

The first caudal vertebra was found fusing with sacrum with 4 segments as well as with 4½ ones **(fig. 1 & 4)**. The fused first caudal vertebra is usually demarcated from the sacral segments by notches along the edges of the sacrum instead of foramina completely surrounded by bones.

The number of the sacral vertebrae equals half the number of the sacral foramina plus one. The number of the sacral foramina, however, at times can differ on the two sides in consequence of asymmetrical formations at either end of the sacral region. Such transitional lumbo-sacral or sacrocaudal vertebrae are classified by half segments **(Stecher, 1962)**. **(Fig. 5 A.B.C.D)**

The number of the sacral vertebrae is normally 5, but 4 and 6 do occur and, in old horses, the first caudal may be fused to the last sacral **(Jeffcott, 1980). Stecher (1962)** who investigated 256 skeletons of different species of the genus Equus stated that the shortest sacra were found in Shetland ponies, horses, Arabians and Prjevalsky horses. While, the longest sacra were found in Grevy zebras, zebras, donkeys and hemiones. Moreover, The same author reported that horses with 5 lumbar vertebrae had longer sacra than horses with 6 lumbar vertebrae. He mentioned also that tendency toward compensation is seen because specimens with a smaller number of lumbar vertebrae often have a larger number of sacral vertebrae or a larger number of attached caudal vertebrae.

It is known that the M. longissimus dorsi is the most important muscle in the back. It is made up of a large number of relatively small segments and is the most powerful extensor of the back and loins. Acting together, it flexes the spine laterally and by its cervical attachment assists in extending the neck. The muscle originates on the tuber, crest and adjacent part of the ventral surface of the ilium, the first three sacral spines and the lumbar and thoracic spines and the supraspinous ligament. So, the occasional presence of extra spines for the sacrum is supposed to increase the area of the muscle attachment and in turn gives more support and strength to its action.

Concerning the role of sacrum in the movement, Hildebrand (1959) and Gamberyam (1974) stated that during locomotion the maximum dorsoventral movement of the thoraco-lumber (TL) spine occurs at the lumbosacral junction and virtually no movement takes place at the sacroiliac articulation. Jeffcot and Dalin (1980) added that there is much greater mobility between the lumber and sacral vertebrae than between individual lumbar vertebrae. This is reflected by the increased size of the spinous processes and the fact that the lumbar spines slope forward and the sacral spines backward. Moreover, they may constitute a site of weakness because, in addition to increased mobility , there is no supraspinous ligament crossing the gap between $L_1$ and $S_1$ to strengthen the vertebral column. In racehorses this region is a common site of pain, perhaps resulting from muscle strain due to overextension of the lumbosacral spine (i.e. ventoflexion). Taking the assumption of Jeffcot and Dalin (1980) in consideration, more segments for the donkey spine may be a weak point theoretically.

The significance of attached caudal vertebrae is uncertain. They may be developmental peculiarities, anatomical anomalies or pathological lesions.**(Stecher, 1962)**. This fusion of the caudal vertebrae can occur at a young age before maturity is attained **(Stecher and Goss, 1961).**

## Conclusion

From the results of this report we can conclude :

1) Numerical variations in the sacral segment is not uncommon in donkeys. Usually, the sacrum of the donkey consists of 5 segments, but 4, 4½ , 6 segments are also found.
2) This numerical variation seems not precluding the physical fitness of the animal.


**Fig. (1)** : Photograph of a normal donkey sacrum with 4 fused vertebrae and an attached caudal vertebrae( Left view )

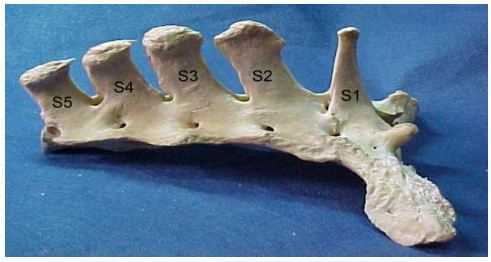


**Fig. (2)** :Photograph of a normal donkey sacrum with five fused vertebrae (Right view )

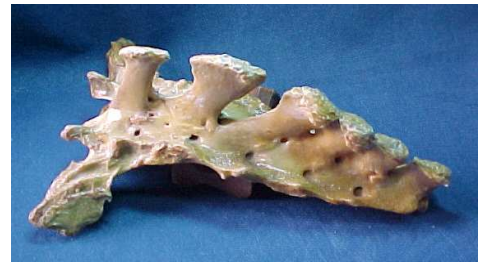

**Fig. (3)** :Photograph of a normal donkey sacrum with six fused vertebrae.( Left view ).

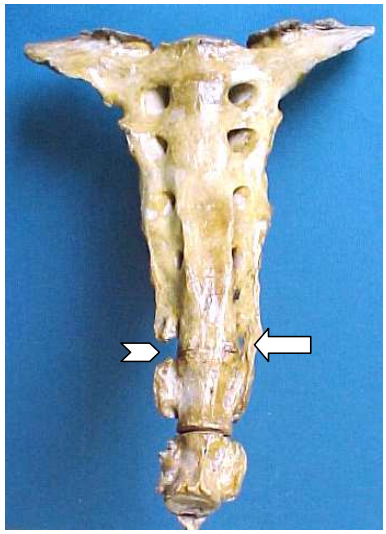

**Fig.(4)** Photograph of an asymmetrical sacrum of a donkey with 4½ sacral segments. Actually, there are 4 right sacral and 5 left sacral segments. The last segment is a sacro-caudal vertebra.

**Notice** : The lateral bony boundary of the last sacral foramen is present on the left side (arrow) and is missed on the right side ( arrow head).

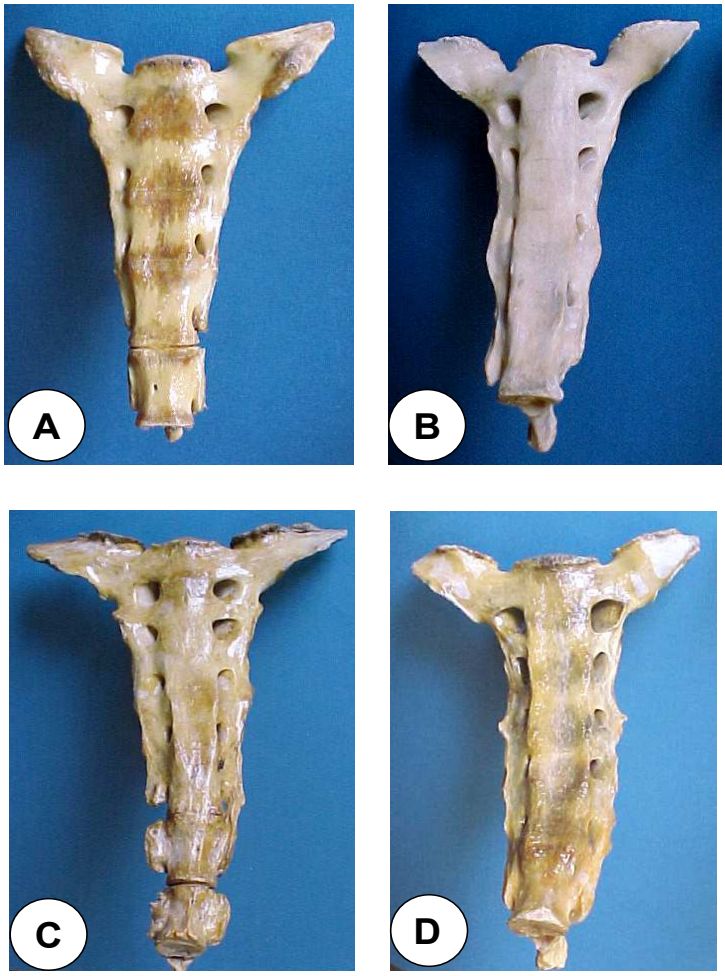


**Fig. (5)** Ventral views of different donkey sacra with 3 & 4 & 4½ & 5 Sacral foramina according to the sacral segments of each (A,B,C,D respectively ).

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