



BIOMETRY OF LUMBAR VERTEBRAE IN TIGER (*Panthera tigris*)

TIWARI Y.^{1*}, TALUJA J.S.¹, VAISH R.¹, PANDEY A.² AND SHRIVASTAV A.B.³

¹Department of Veterinary, Anatomy and Histology, College of Veterinary Science and Animal Husbandry, Jabalpur- 482 001, MP, India.

²Department of Animal Breeding and Genetics, College of Veterinary Science and Animal Husbandry, Jabalpur- 482 001, MP, India.

³Department of Wildlife Health and Management, College of Veterinary Science and Animal Husbandry, Jabalpur- 482 001, MP, India.

*Corresponding Author: Email- tiwari.yogita@rediffmail.com

Received: July 26, 2012; Accepted: March 06, 2014

Abstract- The backbone of tiger is very flexible. This is what allows it to have such a wide range of motion. This is always what allows it to leap more than 30 feet at a time when it needs to. Tiger forms the apex of the pyramid of food chain. Tigers killed for many products like fat is valued as an aphrodisiac and as a remedy for rheumatism. Lumbar vertebrae form the skeleton of loins. There were seven lumbar vertebrae in tiger and column was found 31.76±0.05 cm long excluding intervertebral cartilages. The bodies of lumbar vertebrae were longer than thoracic vertebrae. The dorsal spine was prominent and flattened laterally, the free end was tuberos. Each transverse process was a long plate of bone spreading out laterally directed forward and downward.

Keywords- Panthera tigris, intervertebral, lumbar, vertebrae, spine, process.

Citation: Tiwari Y., et al (2014) Biometry of Lumbar Vertebrae in Tiger (*Panthera tigris*). World Research Journal of Anatomy, ISSN: 2321-4430, Volume 2, Issue 1, pp.-024-027.

Copyright: Copyright©2014 Tiwari Y., et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Introduction

The felid family consists of two major subgroups, the saber-toothed and the feline cats, to which all extinct species belong, and are the most anatomically derived of all carnivores for predation on large prey with a precision killing bite.

The backbone of tiger is very flexible. This is what allows it to have such a wide range of motion. This is always what allows it to leap more than 30 feet at a time when it needs to.

Tiger forms the apex of the pyramid of food chain. Tigers killed for many products like fat is valued as an aphrodisiac and as a remedy for rheumatism. The clavicles or 'lucky bones' which are rudimentary collar bones found loose in the muscles of lower neck near the shoulder joint, and claws are prized as charm and ornaments. The whiskers may be used as a love-charm or be pounded in to a mechanical poison to rid one of an enemy. The liver is eaten to impart courage, and the milk of a tigress is applied to soothe ailments of eye. The beautiful furs naturally objects of value to man.

It is necessary to know about tiger's anatomy. So that it can be applied as a tool for identification, information in tiger monitoring its treatment and protection to save our environment.

The immediate problem for a scientist is to come up with class characteristics that distinguish and identify family, genus, and species of animals that are separate and distinct from population and individual characteristics. This is not a problem with whole animals it is very much a problem in the case of wildlife parts and products where in the commonly occurring species-defining characteristics of the animal source may not be present.

Objective

To study the gross anatomical characteristics of lumbar vertebrae in tiger (*Panthera tigris*).

Review of Literature

Evans & Christensen [1] reported that in dog, lumbar vertebrae were 7 in number and had longer body than the thoracic vertebrae. They gradually increased in width throughout the series and in length through the first five or six segments.

Sisson [2] made observation on lumbar vertebrae of dog and reported that spinous processes were broad ventrally and narrow dorsally and with the exception of the last, inclined a little cranially.

Pandit [3] made observation on lumbar vertebrae of tiger and reported that lumbar vertebrae were 7 in number. Articular processes were short and the facets on cranial processes face upward and those on caudal processes face downwards.

Taluja, et al [4] conducted the osteometrical study on the lumbar vertebrae and mentioned that there were seven lumbar vertebrae present in tiger. The transverse diameter of the vertebral foramen gradually increased caudad.

Kumar [5] reported that there were 7 lumbar vertebrae in leopard. Length of the body gradually increased upto 6th lumbar vertebra then decreased in the last. The caudal extremity of the body was centrally depressed. The mamillary processes surmounted the cranial articular process and they were longest in the 3rd and widest in the 1st lumbar vertebrae.

Material and Methods

Place of Study

The work was carried out in the Department of Veterinary Anatomy and Histology, College of Veterinary Science and Animal Husbandry, Madhya Pradesh Pashu Chikitsa Vigyan Vishwavidyala, Jabalpur (MP), India.

Study Animals

Gross anatomical and radiographic study was conducted on axial skeletons of 5 adult tigers of either sex procured two skeletons from Department of Veterinary Anatomy and Histology, two from Department of Wildlife Health and Management, College of Veterinary Science and Animal Husbandry. Madhya Pradesh Pashu Chikitsa Vigyan Vishwavidyala, Jabalpur (MP), India and one from museum of Van-Vihar National Park, Bhopal (MP), India.

Technical Programme

Characteristic Features

Number and characteristic features of body, transverse process, spinous process, cranial and caudal articular processes and mamillary and accessory process.

Mensuration

- Weight of individual lumbar vertebrae was taken.
- Length and Width of body of vertebrae of lumbar region was measured.
- Height and width of spinous process of individual vertebra of lumbar region was measured.
- Length and width of transverse process of individual vertebra of lumbar region and length and width of articular process of individual vertebra of lumbar region was measured.
- Vertical diameter and transverse diameter of vertebral ring from cranial and caudal end was measured.
- Mamillary process and accessory processes was taken.

Statistical Analysis

The data collected were analyzed for mean and standard error as per the standard procedure of Panse & Sukhatme [6] and Snedecor & Cochran [7].

Results

There were seven lumbar vertebrae in tiger and column was found 31.76±0.05 cm long excluding intervertebral cartilages. These vertebrae showed excessive developed transverse processes.

Body

The body was in the form of long cylindrical mass. The bodies of lumbar vertebrae were longer than thoracic vertebrae. The length of the body was 4.00±0.04 cm in the first, they gradually increased in the size from first to sixth (5.20±0.04 cm) the length of seventh (4.12±0.06 cm) vertebra was approximately similar to length of body of first [Table-1]. The caudal extremity of the body was centrally depressed [Plate-4].

Spinous Processes

The dorsal spine was prominent and flattened laterally, the free end was tuberos. The size of tuberosity of free end of spinous process

gradually decreased in the succeeding vertebrae [Plate-4]. The height of spinous process increased gradually in succeeding vertebrae except sixth and seventh, which had approximately equal length. The height of spinous process was 3.22±0.06 cm in the first, 4.32±0.07 cm in the sixth, and 4.22±0.00 cm in the last lumbar vertebra [Table-1].

The ventral spine was in the form of a longitudinal ridge which divided the ventral surface of the body into two concave areas. The ventral spine was prominent from first to fifth and it was faint in sixth and eventually in the seventh, it was inappreciable.



Plate. 1- 1st & 2nd lumbar vertebrae (lateral view) (a) Cranial articular process; (b) Spinous process; (c) Transverse process; (d) Accessory process; (e) Caudal articular process; (f) Body.

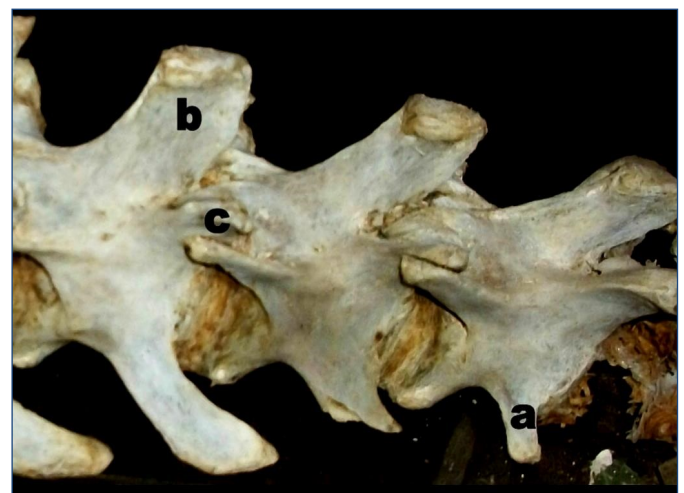


Plate. 2- 1st, 2nd & 3rd lumbar vertebrae (lateral view) (a) Transverse process; (b) Spinous process; (c) Cranial articular process

Articular Processes

The cranial articular processes were curved and greater in size than the caudal articular processes and showed concave articular surfaces [Plate-3]. The caudal articular processes were straight and the surfaces were flattened.

Transverse Processes

Each transverse process was a long plate of bone spreading out laterally directed forward and downward. Dorsal surface of transverse processes of fifth and sixth lumbar vertebrae, in its distal

parts showed a ridge which divided the dorsal surface into upper flattened and lower concave area [Plate-3]. The lower concave area in the fifth was in the form of a narrow strip while in 6th lumbar vertebra, the distal concave part was greater than the proximal flattened part [Plate-3]. The external surface of the transverse process of seventh lumbar vertebra was convex above and concave below [Plate-4].

The transverse process of first lumbar vertebra was smallest and directed downward, the distal free end was thick and rough. The transverse process from second to fifth lumbar vertebra was in the form of curved and flattened plate and directed downward and forward [Plate-4]. The length of transverse process increased in the succeeding vertebrae and was recorded 3.75±0.08 cm in the first and 6.28±0.03 cm in the last lumbar vertebra [Table-1].

Table 1- Range, mean and S.E. of different parameters of lumbar vertebrae

Parameters	1st		2nd		3rd		4th		5th		6th		7th	
	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE
Width (cm)														
Anterior	3.60 - 3.70	3.66±0.03	3.50 - 3.80	3.60±0.06	3.40 - 3.60	3.50±0.04	3.60 - 4.00	3.78±0.09	3.40 - 3.80	3.54±0.08	4.00 - 4.20	4.08±0.04	4.10 - 4.40	4.28±0.06
Middle	3.00 - 3.60	3.20±0.12	3.10 - 3.60	3.28±0.11	3.00 - 3.50	3.16±0.10	3.20 - 3.60	3.34±0.08	3.30 - 3.70	3.48±0.06	3.70 - 3.90	3.82±0.03	3.80 - 4.30	4.02±0.08
Posterior	3.60 - 3.90	3.74±0.06	3.80 - 4.10	3.94±0.06	4.00 - 4.10	4.04±0.03	3.90 - 4.60	4.22±0.13	4.20 - 4.40	4.30±0.04	4.30 - 4.60	4.42±0.07	4.30 - 4.50	4.40±0.04
Length (cm)	3.90 - 4.10	4.00±0.04	4.00 - 4.30	4.18±0.06	4.40 - 4.50	4.46±0.03	4.70 - 4.80	4.76±0.02	5.00 - 5.10	5.04±0.03	5.10 - 5.30	5.20±0.04	4.00 - 4.30	4.12±0.06
Articular process														
Cranial														
Length (cm)	1.60 - 2.30	1.83±0.23	1.50 - 2.30	1.87±0.06	1.90 - 2.60	2.13±0.23	2.40 - 2.50	2.47±0.03	2.00 - 2.20	2.07±0.07	1.70 - 2.20	1.90±0.15	2.00 - 2.10	2.03±0.03
Width (cm)	1.30 - 1.50	1.40±0.06	1.10 - 1.30	1.20±0.06	1.20 - 1.50	1.33±0.09	1.50 - 1.60	1.57±0.03	1.20 - 1.60	1.33±0.13	1.40 - 1.60	1.47±0.07	1.30 - 1.60	1.43±0.09
Caudal														
Length (cm)	1.40 - 2.20	1.67±0.27	1.20 - 2.20	1.83±0.32	1.60 - 2.30	1.90±0.21	1.70 - 1.90	1.80±0.06	1.80 - 2.10	1.93±0.09	1.80 - 2.30	2.00±0.15	1.80 - 2.30	2.00±0.15
Width (cm)	1.30 - 1.50	1.40±0.06	1.20 - 1.50	1.33±0.09	1.20 - 1.60	1.43±0.12	1.70 - 1.80	1.77±0.03	1.50 - 1.90	1.67±0.12	1.40 - 2.00	1.63±0.19	1.20 - 1.90	1.47±0.22
Transverse process														
Length (cm)	3.60 - 3.70	3.75±0.08	4.00 - 4.30	4.16±0.06	4.50 - 4.80	4.58±0.06	5.10 - 5.30	5.22±0.03	6.00 - 6.20	6.12±0.04	6.00 - 6.40	6.22±0.08	6.20 - 6.40	6.28±0.03
Width (cm)	1.30 - 1.60	1.42±0.06	1.10 - 1.40	1.24±0.06	1.40 - 1.90	1.58±0.10	1.60 - 1.80	1.70±0.05	1.70 - 2.20	1.92±0.11	1.70 - 2.00	1.84±0.06	1.90 - 2.10	2.02±0.04
Spinous process														
Height	3.10 - 3.40	3.22±0.06	3.40 - 3.80	3.52±0.08	3.90 - 4.80	4.06±0.06	4.10 - 4.30	4.22±0.04	4.00 - 4.30	4.14±0.04	4.10 - 4.40	4.32±0.07	4.20 - 4.30	4.22±0.00
Width (cm)														
Base	3.50 - 3.90	3.62±0.08	3.60 - 3.90	3.72±0.06	3.70 - 4.10	3.88±0.06	3.60 - 3.80	3.70±0.02	3.40 - 3.70	3.56±0.04	3.00 - 3.20	3.10±0.04	2.70 - 3.00	2.82±0.06
Middle	2.10 - 2.60	2.28±0.10	2.40 - 2.80	2.64±0.06	2.40 - 2.70	2.54±0.04	2.40 - 2.60	2.50±0.04	2.10 - 2.30	2.20±0.04	1.70 - 1.90	1.78±0.04	1.70 - 1.90	1.82±0.04
Apex	1.80 - 2.10	1.94±0.06	2.10 - 2.10	2.10±0.00	1.80 - 2.00	1.86±0.04	1.60 - 1.80	1.70±0.04	1.20 - 1.50	1.36±0.06	0.90 - 1.00	0.98±0.02	1.10 - 1.20	1.14±0.03
Vertebral Ring														
Vertical dia.(cm)														
Cranial	1.50 - 1.90	1.67±0.12	1.90 - 1.90	1.90±0.00	1.80 - 2.30	2.03±0.15	1.90 - 2.30	2.07±0.12	1.90 - 2.30	2.03±0.20	1.70 - 2.10	1.90±0.12	1.60 - 2.10	1.77±0.17
Caudal	1.60 - 2.00	1.76±0.12	1.70 - 2.00	1.83±0.09	2.00 - 2.50	2.20±0.15	2.00 - 2.40	2.13±0.13	1.60 - 2.30	1.93±.20	1.60 - 2.00	1.83±0.12		1.67±0.22
Transverse dia.(cm)														
Cranial	2.10 - 2.40	2.27±0.09	2.40 - 2.40	2.40±0.00	2.50 - 2.70	2.57±0.07	2.70 - 2.80	2.77±0.03	2.50 - 2.90	1.93±0.20	2.50 - 3.00	2.70±0.15	3.00 - 3.30	3.13±0.22
Caudal	2.40 - 2.70	2.53±0.09	2.50 - 2.90	2.67±0.00	2.80 - 3.40	3.03±0.19	2.80 - 3.70	3.20±0.26	3.20 - 4.30	3.77±0.32	3.40 - 3.50	3.43±0.03	4.20 - 4.40	4.30±0.06
Mamillary process														
Length (cm)	1.00 - 1.10	1.03±0.03	1.10 - 1.20	1.16±0.03	1.20 - 1.30	1.23±0.03	0.90 - 1.00	0.97±0.03	0.80 - 1.00	0.95±0.05	0.60 - 0.80	0.72±0.04	0.80 - 1.00	0.86±0.04
Width (cm)	1.50 - 1.80	1.60±0.10	1.10 - 1.30	1.17±0.07	0.80 - 1.60	1.10±0.25	1.00 - 1.60	1.23±0.19	1.20 - 1.40	1.30±0.08	1.00 - 1.00	1.00±0.00	1.30 - 1.50	1.40±0.04
Accessory process														
Length (cm)	2.00 - 2.80	2.43±0.23	1.80 - 2.10	1.93±0.09	1.30 - 1.50	1.40±0.06	0.80 - 1.30	1.07±0.15	0.60 - 0.70	0.60±0.06	-	Reduced	-	Reduced
Width (cm)	1.00 - 1.10	1.03±0.03	0.50 - 0.80	0.60±0.1	0.30 - 0.80	0.53±0.15	0.30 - 0.50	0.40±0.06	0.30 - 0.40	0.37±0.03	-	Reduced	-	Reduced
Weight (gm)	70.30 - 79.20	74±2.68	71.10 - 73.80	72.03±0.88	78.60 - 80.10	79.37±0.43	85.10 - 98.20	90.83±3.87	86.90 - 94.10	89.43±2.34	87.20 - 91.40	89.27±1.21	85.30 - 96.80	90.07±3.47

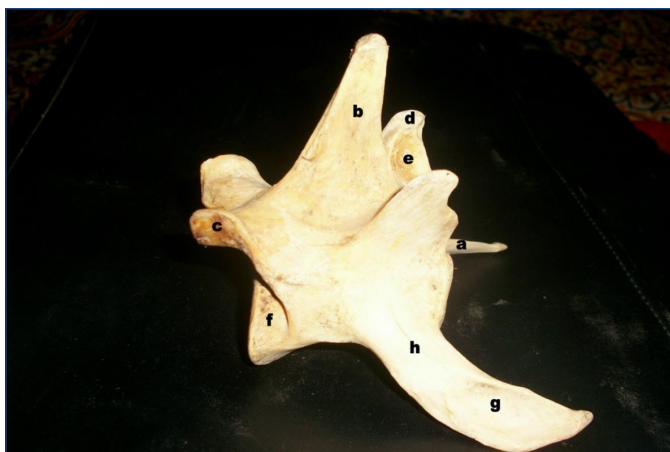


Plate. 3- Sixth Lumbar vertebra (lateral view) (a) Transverse process; (b) Spinous process; (c) Caudal articular process; (d) Mamillary process; (e) Cranial articular process; (f) Body; (g) Lower concave area; (h) Upper flattened area.



Plate. 4- Lumbar vertebrae (lateral view) 1st, 7th. 1st and 7th. Lumbar vertebrae; (a) Transverse process; (b) Spinous process; (c) Caudal articular process; (d) Mamillary process; (e) Cranial articular process; (f) Accessory process; (g) Upper flattened area; (h) Lower concave area.

Mamillary Processes and Accessory Processes

The mamillary processes surmounted the cranial articular process [Plate-2] and were longest in the third and widest in the first lumbar vertebrae [Plate-2]. The length and the width of the mamillary processes were 1.10 ± 0.06 cm and 1.10 ± 0.25 cm in the third and 1.13 ± 0.09 cm and 1.60 ± 0.10 cm in the first respectively [Table-1]. The accessory processes were present between transverse process and caudal articular process [Plate-1]. The accessory process was longest in the first than the length decreased gradually up to fifth lumbar vertebra. The length and width was 2.43 ± 0.23 cm and 1.03 ± 0.03 cm in the first, 0.60 ± 0.06 cm and 0.37 ± 0.03 cm in the fifth [Table-1]. They were absent in sixth and seventh lumbar vertebrae.

Discussion

There were seven lumbar vertebrae in tiger. Length of the body gradually increased up to sixth lumbar vertebra then decreased in the last. The caudal extremity of the body was centrally depressed. The cranial articular processes were curved and greater in size than the caudal

articular process and showed concave articular area. The caudal articular processes were straight and the facets were flattened. The mamillary processes surmounted the cranial articular process and they were longest (1.23 ± 0.03 cm) in the third and widest (1.60 ± 0.10 cm) in the first lumbar vertebrae. The accessory processes were present between transverse process and caudal articular process. The accessory process was longest in the first (2.43 ± 0.23 cm) then the length decreased gradually up to fifth (0.60 ± 0.06 cm). They were absent in sixth and seventh. These observations were in agreement with the study of Pandit [3] and Taluja, et al [4] in tiger and Kumar [5] in leopard; they found similarity in number of lumbar vertebrae and structure of cranial and caudal articular process. Accessory processes were also absent in leopard in sixth and seventh lumbar vertebrae. Sisson [2] also reported similar findings in case of dog.

Conflicts of Interest: None declared.

References

- [1] Evans H.E. & Christensen G.C. (1964) *Anatomy of the Dog*, Publ., W.B. Saunders Co., Philadelphia, 941.
- [2] Sisson R. (1975) *Sisson and Grossman's the Anatomy of the Domestic Animals*, 1427-1503.
- [3] Pandit R.V. (1994) *Osteology of Indian tiger (Panthera tigris)*. Tech. Bull. No. VI, Conservator of Forest and Director, Project Tiger, Melghat, Amravati, 1-27.
- [4] Taluja J.S., Malik M.R. & Parmar M.L. (2000) *Osteometry of Lumbar Vertebrae in Tiger*, 22-25 22.
- [5] Kumar R. (2008) *Studies on characteristic features of axial skeleton of leopard as an aid in wildlife forensic*, M.V.Sc. Thesis, JNKVV, Jabalpur, 59.
- [6] Panse V.G. & Sukhatme P.V. (1967) *Statistical Methods for Agricultural Workers*, 152-157.
- [7] Snedecor G.W. & Cochran W.G. (1994) *Statistical Methods*, 593.
- [8] Taluja J.S. & Malik M.R. (1997) *Osteometry of Precoccyheal Vertebral Column in Tiger*, 44