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Comparative gross anatomy of the sixth cervical vertebra in chiru (*Pantholops hodgsoni*) and sheep (*Ovis aries*)

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Abstract

The present study was conducted on the sixth cervical vertebra of chiru and sheep in Kashmir division of state Jammu and Kashmir from April 2016 to August 2016 to arrive at their comparative gross anatomical differences. The cervical vertebrae were macerated by wet maceration, disarticulated, cleaned and arranged in order for various vertebral regions and the sixth cervical vertebra was removed from the specimen. Six cervical vertebrae (sixth) of adult sheep were also utilized for the present study. The morphological features which include body, processes and neural arch and various biometrical observations of the sixth cervical vertebra of chiru were studied, and compared with the same characteristics and parameters of the same vertebrae of sheep. This vertebra of chiru presented a short body, prominent supraspinous and bifid transverse processes and two well-developed lateral notches on posterior aspect of dorsal arch, that differentiate it from sixth cervical vertebra of sheep. The body of the sixth cervical vertebra of chiru was relatively longer (3.8cm) than that of sheep (3.4±0.05cm). The dorsoventral diameter at the anterior and posterior extremity of body of chiru was 2.3 cm and 2.5 cm while as transverse diameter of same was 1.5 cm and 2.3 cm respectively. In case of sheep, the dorsoventral diameter at the anterior and posterior extremity of body was 1.28±0.030cm and 2.05±0.02 cm while as transverse diameter in the same manner was 1.20±0.007 cm and 1.79±0.007 cm respectively in the present study, the biometrical parameters revealed that the values were generally higher in chiru as compared to sheep.

Keywords: Biometry, chiru, sheep, sixth cervical vertebra

1. Introduction

The Tibetan antelopes alias chiru still follow their traditional routes to Aksai-Chin area in small numbers in the eastern Ladakh^[1, 2] but are vulnerable to hunting specifically by the para military forces present in the region^[3]. The chiru is listed threatened with extinction in the IUCN Red Data List^[4]. The species inhabits an area of approximately 1,600 km across the Tibetan Plateau with its eastern limit near Ngoring Hu (China) and the western limit in Ladakh, India^[5]. The endangered chiru a small ruminant of the family bovidae, whose fine wool is used to weave the prized Shahtoosh shawl^[6], is protected by Wild Life Act of Jammu and Kashmir and India under schedule I of the act^[7]. Further chiru being a highly priced animal, poachers do hunt this animal. This morphometrical study was conducted to compare the sixth cervical vertebra of chiru with that of sheep, which could prove a basic tool to arrive at the identification of carcasses in various vetrolgal cases as presented to Wild Life Department.

2. Materials And Methods

The study was conducted in the division of veterinary anatomy and histology of faculty of veterinary sciences and animal husbandary Shuhama Ganderbal SKUAST-K. A cervical region of adult chiru was provided by the Division of Animal Breeding and Genetics, Shere Kashmir University of Agricultural Sciences and Technology of Kashmir. The cervical vertebrae were macerated by wet maceration, disarticulated, cleaned and arranged in order for various vertebral regions and the sixth cervical vertebra was removed from the specimen. Six cervical vertebrae (sixth) of adult sheep were also utilized for the present study. Osteological characteristics of sixth cervical vertebra of chiru were recorded and compared with same vertebrae of sheep. The data collected from different parts and regions of these vertebrae was

processed using the SPSS Software for descriptive analysis including, mean and standard error^[8].

3. Results and Discussion

The sixth cervical vertebra of chiru was atypical vertebrae as found in sheep. The morphological features of the sixth cervical vertebra of chiru which included body, processes and neural arch generally resembles with 3rd, 4th and 5th cervical vertebrae. The body of the sixth cervical vertebra of chiru was relatively longer (3.8cm) than that of sheep (3.4±0.05cm) as in barking deer (Shalini *et al*)^[9]. The concavity of the posterior end of the body was deeper in chiru than that sheep similar as reported, the shallowness of the concavity of the posterior end of this vertebra in sheep by (Nickel *et al.* and Sisson)^[10, 11].

Supraspinous process was more pronounced and longer than that of preceding cervical vertebra. Its average height was 2.2 cm, width 1.3 cm, thickness 0.5 cm and was directed upwards and forwards (Fig.1). In sheep, this process was with an average height of 1.83±0.03 cm, width of 1.10±0.02 cm and thickness of 0.45±0.01 cm

Transverse process was bifid (Fig. 1). The average length, width and thickness of the dorsal plate was 0.1 cm, 1.15 cm and 0.45 cm while as that of ventral plate were 4.6 cm, 2.25 cm and 0.55 cm respectively. In sheep average length, width and thickness of the dorsal plate was 0.97±0.04 cm, 0.85±0.02 cm and 0.40±0.006 cm while as that of ventral plate were 3.17±0.04 cm, 1.82±0.02 cm and 0.49±0.009 cm respectively. The ventral division of this process was more pronounced and modified into a large thick quadrilateral bony plate with thick borders as in sheep (Fig. 1) and in other domesticated animals (Getty *et al*)^[12]. The fossa present at the junction of dorsal and ventral parts of the transverse process and caudolateral to the foramen transversarium was shallower in chiru with respect to sheep (Fig. 1). The fossa present between the anterior and posterior just above the dorsal part of transverse process was shallower in chiru resembling with that of all other domesticated animals and similar to observations made in sheep by (Dyce *et al.*)^[13]. Posterior articular process is shorter and thicker than anterior one (Fig. 1). The distance between anterior articular process in chiru was 2.4 cm, and between posterior articular process was 2.5 cm and that between the anterior and posterior was 2.3 cm, whereas in sheep it was 1.71±0.014cm, 1.60±0.007cm and 1.79±0.023 cm in the same manner. The dorsoventral diameter at the anterior and posterior extremity of body of chiru was 2.3 cm and 2.5 cm while as transverse diameter of same was 1.5 cm and 2.3 cm respectively. In case of sheep, the dorsoventral diameter at the anterior and posterior extremity of body was 1.28±0.030cm and 2.05±0.02 cm while as transverse diameter in the same manner was 1.20±0.007 cm and 1.79±0.007 cm respectively. The dorsoventral diameter at the anterior and posterior extremity of chiru neural canal was 1.6 cm and 1.4 cm while as transverse diameter of same was 1.9 cm and 1.8 cm respectively. In case of sheep the dorsoventral diameter at the anterior and posterior extremity of neural canal was 1.02±0.03 cm and 1.11±0.03 cm while as transverse diameter of same was 1.18±0.03 cm and 1.48±0.03 cm respectively. The dorsoventral diameter at the anterior and posterior extremity of foramen transversarium of chiru was 0.9 cm and 0.7 cm while as transverse diameter of same was 0.5 cm and 0.7 cm respectively. In case of sheep the dorsoventral diameter at the anterior and posterior extremity of foramen transversarium was 0.49±0.025 cm

and 0.4±0.008 cm while as transverse diameter of same was 0.54±0.027 cm and 0.45±0.005cm respectively. Two lateral notches were present on either side of posterior border of dorsal arch in chiru (Fig. 1) which were absent in sheep. In the middle part of the neural surface of the body of chiru have two foramina and which are opened into the foramen transversarium whereas, in case of sheep 1-2 foramina were present and sometimes found to be absent, which were similar to observations made by (Nickel *et al.*)^[10]

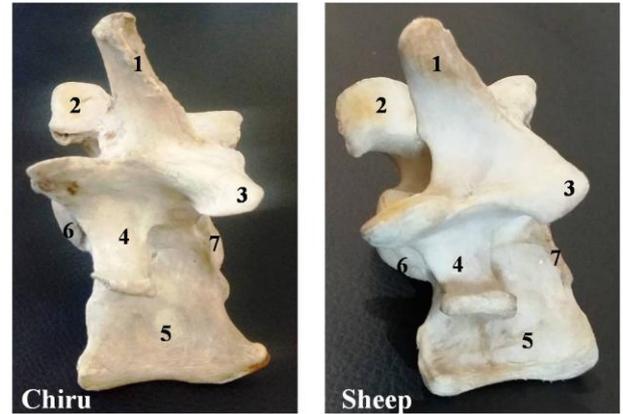


Fig 1: Lateral view of 6th cervical vertebrae showing supraspinous process (1), anterior articular process (2), posterior articular process (3), dorsal plate of transverse process (4), Ventral quadrilateral plate of transverse process (5), Anterior extremity of body (6) and posterior extremity of body (7)

4. Conclusion

Over the years, the population of chiru has declined alarmingly primarily due to poaching in Tibet for its prized under wool used in weaving of Shahtoosh shawls. Morphometric analysis of the vertebrae and subsequent comparison with other closely related animals like sheep revealed that the values of different biometrical parameters were generally higher in chiru as compared to sheep which could act as a forensic tool to identify species. Further the literature available on the biometry of axial skeleton of chiru is scanty, thus this study could be used a basic tool for the future studies in the relevant field.

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