Indian Journal of Veterinary Anatomy 37(2): 70-74, December 2025

Comparative Gross Morphological Study on the Pituitary Glands of Pig (*Sus scrofa domestica*) and Goat (*Capra hircus*)

V.Harideep[1*], M.Santhi Lakshmi[1], P.Jagapathi Ramayya[1], S.Bharathi[2], V. Reddy Dhyana[3], T.S. Chandrasekhara Rao[1], K.Raja[1], B.Supriya[1], M.Kalyan Chakravarthy[4]
Department of Veterinary Anatomy, College of Veterinary Science,
Sri Venkateswara Veterinary University, Tirupati.

Received: 19.11.2025; Accepted: 20.12.2025

ABSTRACT

The pituitary gland (hypophysis cerebri) plays a central role in regulating growth, metabolism, reproduction, and homeostasis through its endocrine functions. The present study was undertaken to comparatively evaluate the gross morphology and morphometry of the pituitary gland in pigs and goats. The study was conducted on eight adult Large White Yorkshire crossbred pigs and six adult goats. Following careful dissection, the pituitary glands were examined for their location, relations, external morphology, lobation and biometric parameters. In both species, the pituitary gland was located on the ventral aspect of the diencephalon within the sella turcica and connected to the hypothalamus by the infundibular stalk. However, distinct species-specific differences were observed. The diaphragma sellae was incomplete with a large central aperture in pigs, whereas it was complete with a minute opening in goats. Externally, the gland was irregularly triangular in pigs and elongated oval to pyriform in goats. Sagittal sections revealed clear lobation of the adenohypophysis and neurohypophysis in both species, with more prominent hypophyseal cleft and compact lobation in goats. Morphometric analysis showed that width, thickness, volume, and weight of the pituitary gland were significantly greater in pigs compared to goats ($P < 0.01$), while length did not differ significantly. These findings demonstrate marked species-specific variations in pituitary morphology and morphometry, providing valuable baseline data for comparative anatomy and endocrinological studies in domestic animals.

Keywords: Diaphragma sellae, Hypophysis cerebri, Neurohypophysis, Pituitary gland, Sella turcica

INTRODUCTION

The pituitary gland, also known as the hypophysis cerebri, is a central endocrine organ responsible for regulating critical physiological processes such as growth, reproduction and metabolism through its diverse populations of hormone secreting cells. The pituitary gland serves as a functional interface between the nervous and endocrine systems by integrating neural signals with endocrine outputs. Unlike neural transmission, which occurs rapidly via electrical and chemical impulses, pituitary hormones act more slowly but exert prolonged and systemic effects on target tissues (Vala *et al.*, 2013). Anatomically, the pituitary gland is divided into two major components:the adenohypophysis (anterior pituitary) and the neurohypophysis (posterior pituitary), each with distinct embryological origins and functional roles (Ye *et al.*, 2018). In domestic animals, pituitary gland often referred as “master of the endocrine gland” hormone-secreting cells. due to its regulatory control over other endocrine organs via the secretion of trophic hormones (Dyce *et al.*, 2002). Through its hormonal output, the pituitary conveys regulatory signals to multiple tissues and organs, thereby maintaining physiological stability and homeostasis, similar to other endocrine glands such as the adrenal cortex (Moriarty, 1974). Moreover, several additional physiological and adaptive processes within the body are dependent on pituitary regulation.Comparative anatomical and morphometric studies across domestic animal species are essential for understanding species-specific endocrine adaptations and for developing reliable translational models. Systematic

1.Dept. of Veterinary Anatomy, CVSc, Tirupati, 2.Dept. of VCC, CVSc, Tirupati,3.Veterinary Assistant Surgeon, Veterinary Dispensary, Devapatla, Rayachoty, 4. Principal Scientist, ICAR- AICRP on Pigs, CVSc, Tirupati,SVVU.
*Corresponding author: vakaharideep@gmail.com

comparative studies addressing the gross morphology, lobation and morphometric characteristics of the pituitary gland between pigs and goats are scarce. The lack of such baseline anatomical data represents a significant research gap in comparative veterinary endocrinology.

Therefore, the present study was undertaken to comparatively evaluate the gross morphology, lobation, and morphometric parameters of the pituitary gland in pigs and goats, with the aim of providing baseline anatomical data for future comparative, physiological, and endocrinological investigations.

MATERIALS AND METHODS

The present work was conducted on the eight adult Large White Yorkshire cross bred pigs (SVVU T-17) and six adult goats at the Department of Veterinary Anatomy, CVSc, Tirupati. The specimens of pituitary glands of pigs were collected immediately after slaughter from ICAR All India Coordinated Research Project (AICRP) on pigs. The specimens of pituitary glands of goats were collected immediately after slaughter from local abattoir.

Collection of pituitary glands

Collecting the pituitary glands from pigs and goats involved a meticulous dissection process to access this small, crucial endocrine organ located at the base of the brain. After securing the euthanised specimen, the dissection typically began with a midline incision along the dorsal aspect of the head to expose the frontal bone. Careful removal of the frontal bone was performed using bone-cutting tools, ensuring minimal damage to surrounding tissues and preserving the integrity of the brain. Once the brain was exposed, attention was turned to locate the pituitary gland located within the sella turcica, a bony depression at the base of the skull. The pituitary gland, resembled a tiny pea in size, was delicately dissected free from its attachments using fine surgical instruments such as scissors and forceps. Special care was taken to avoid disrupting nearby structures like the optic chiasma and cranial nerves. Post-dissection, the pituitary glands were collected in a labelled container for subsequent anatomical study.

Gross examination

For gross morphological studies, the collected fresh tissue samples of pituitary glands of adult pig and goat were studied. The location and the relations of the pituitary glands were thoroughly studied in the dissection microscope. After proper washing, the tissue samples were studied and the biometrical dimensions viz., length (anteroposterior diameter), width (lateral diameter) and thickness (dorso-ventral diameter) were recorded (in cm) with the help of vernier callipers. The volume of each gland was recorded (in cc). The weight of each gland was also recorded (in gm). The measurements were analysed statistically using SPSS software version 24.0 (Snedecor and Cochran,1994).

RESULTS AND DISCUSSION

The pituitary gland or hypophysis cerebri is the master endocrine gland (Bloom and Fawcett, 1994). The gland is directly connected to the brain and acts as an important bridge between the nervous and endocrine systems, coordinating both the systems work together to regulate various body functions. It was located on the ventral aspect of the diencephalon and was suspended from the hypothalamus by a slender stalk (Dyce *et al.*, 2002). It was situated in the interpeduncular fossa or behind the level of the optic chiasma over the sella turcica of the sphenoid bone (Figs. 1 and 2). The gland was covered on by the fold of duramater called diaphragma sellae and makes the roof over the pituitary gland (Figs. 1 and 2). The pituitary gland of pig was not covered by the patent diaphragm sellae on the dorsal surface whereas, it was covered on all sides in goats (Rao *et al.*, 2024). There was a small aperture in the middle of the diaphragma sellae, foramen diaphragmaticus, through which the pars tuberalis and the infundibular stem passed rostrally. It was connected to the ventral surface of the hypothalamus by the infundibular stalk and related to the mammillary body caudally as reported in other domestic animals (Getty, 1975 and Nickel *et al.*, 1979) and in humans (Ham, 1969). The aperture was very large in pigs, whereas the aperture appeared to be small and closed with minute space in goat (Figs. 1 and 2),

as the diaphragma sellae is incomplete in pigs and complete in goats. The gland was pale pink in colour after removing the diaphragma sellae in both pig and goat. These statements were in similar to the findings of Komalavalli *et al.,* 2011 in goats and in contrast, Pai and Pathak (2005) stated that the glands were more brownish in buffalo.

In the present investigation, the pituitary gland showed distinct species-specific differences in external morphology. In pigs, the gland was irregularly triangular with a narrow anterior extremity and a broad, blunt posterior end, whereas in goats it was elongated oval to pyriform in shape. A similar pyriform configuration of the pituitary has been reported earlier in goats, supporting the present observations (Rao *et al.*, 2024). Comparative anatomical studies indicate that the overall shape of the pituitary gland varies considerably among domestic and laboratory animals, being oval shaped in buffaloes, flattened and disc-like in rats, and variably ovoid in other mammals (Getty, 1975; Nickel *et al.*, 1979). Such interspecies variation in pituitary morphology has been attributed to differences in skull base architecture, endocrine functional demands, and developmental patterns. Additionally, changes in pituitary size and shape are influenced by age, sex, and seasonal or physiological status of the animal, highlighting the plastic nature of the gland across species (Dent, 1961; Nandeshwar *et al.*, 2023).

On sagittal section of the pituitary gland in both pigs and goats, a clear lobation of the adenohypophysis and neurohypophysis was evident, with distinct identification of their respective subdivisions (Figs. 3 and 4). The adenohypophysis was clearly differentiated into the pars distalis, pars intermedia and pars tuberalis, while the neurohypophysis comprised of median eminence, infundibular stalk and pars nervosa. The boundary between the adenohypophysis and neurohypophysis was marked by a well-defined hypophyseal cleft, which was more conspicuous in goats than in pigs, facilitating clearer demarcation of the pars intermedia. In goats, the pars distalis appeared relatively compact and distinctly separated from the pars nervosa, whereas in pigs the adenohypophysis was comparatively broader with a less sharply defined interface between the pars distalis and pars intermedia. The pars nervosa in pigs was more expansive and loosely arranged, while in goats it was relatively condensed and clearly delineated. These variations in lobation and demarcation likely reflect species-specific differences in pituitary organization, endocrine functional demand and developmental morphology, as reported in other domestic animals and humans (Getty, 1975; Nickel *et al.*, 1979; Ham, 1969). Similar observations of clearer lobular differentiation and a prominent hypophyseal cleft in small ruminants have been documented in caprine pituitary studies, suggesting a more structurally compact hypophyseal architecture compared to non- ruminant species (Rao *et al.*, 2024; Nandeshwar *et al.*, 2023).

The comparative morphometric analysis of the pituitary gland revealed distinct species- specific differences between pigs and goats (Table.1). Although the mean length of the gland did not differ significantly between the two species, the width, thickness, volume and weight were significantly greater in pigs than in goats ($P< 0.01$), indicating an overall larger and more robust gland in pigs. Similar interspecies variations in pituitary morphology have been documented in domestic animals and were generally attributed to differences in skull base configuration, endocrine demands, growth patterns, and metabolic activity (Getty, 1975; Nickel *et al.*, 1979). The relatively smaller pituitary dimensions observed in goats are consistent with earlier morphometric studies in caprine species, which report comparatively compact hypophyseal architecture influenced by age, season, and physiological status (Rao *et al.*, 2024; Nandeshwar *et al.*, 2023). The increased volume and weight of the pituitary in pigs may reflect a greater adenohypophyseal cell mass and higher hormonal output capacity, supporting the concept that pituitary size correlates with functional endocrine requirements across species (Ham, 1969; Getty, 1975). Overall, the present findings reinforce the notion that pituitary morphometry exhibits marked species-specific variation, serving as an important anatomical baseline for comparative endocrinological and physiological investigations.

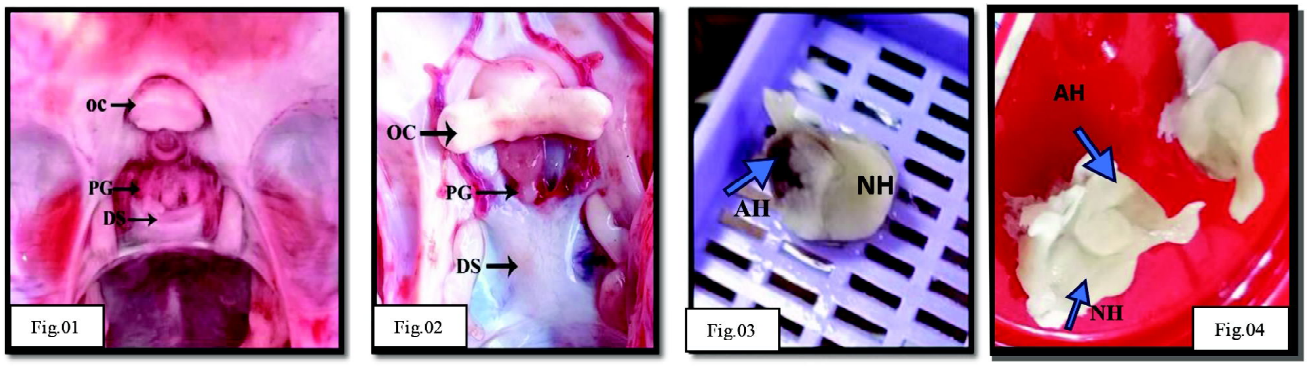

Fig. 1 Gross photograph showing the pituitary gland (PG), diaphragma sellae (DS), optic chiasma (OC) in pigs,**Fig. 2** Gross photograph showing the pituitary gland (PG), diaphragma sellae (DS), optic chiasma (OC) in goats, **Fig. 3** A clear lobation of the adenohypophysis (AH) and neurohypophysis (NH) on sagittal section of the pituitary gland in pigs, **Fig 4** A clear lobation of the adenohypophysis (AH) and neurohypophysis (NH) on sagittal section of the pituitary gland in goats.

Table.1 Comparative morphometric analysis of the pituitary gland

Parameter	Pig	Goat	Significance
Length	1.04^{a}±0.01	1.09^{a}±0.03	NS
Width	0.79^{b}±0.01	0.70^{a}±0.01	**
Thickness	0.75^{b}±0.01	0.50^{a}±0.03	**
Volume	0.61^{b}±0.01	0.38^{a}±0.02	**
Weight	0.46^{b}±0.01	0.37^{a}±0.01	**

NS: Non-significant, **P<0.01, Means bearing different superscripts in a row differ significantly

REFERENCES

Bloom, W. and Fawcett, D.W. 1994. A Textbook of Histology. 12th Edn., Chapman and Hall, New Edn., Chapman and Hall, New York.

Dyce, K.M., Sack, W.O. and Wensing, C.J.G. 2002. Textbook of Veterinary Anatomy.3rd Edn., W. B. Saunders Company, Philadelphia, pp. 294.

Getty,R., 1975. Sisson and Grossman's The Anatomy of the Domestic Animals. 5th Edn., W.B. Saunderss Company, Philadelphia.

Ham, A.M., 1969. Histology. 6th Edn., Lippincott Company, Philadelphia and Toronto, Tokyo, pp.817-824.

Komalavalli, M., Balasundaram, K. and Kumaravel, A. 2011. Gross Anatomy of Pituitary Gland in Doe (*Capra hircus*) of Different Age Groups. *Indian Journal of Veterinary Anatomy*. 23(1): 10-13.

Moriarty G.C. 1973. Adenohypophysis: ultrastructural cytochemistry. A review. *The journal of histochemistry and cytochemistry: official journal of the Histochemistry Society*, 21(10): 855-94. https://doi.org/10.1177/21.10.855.

Nandeshwar, N., Banubakode, S., Charjan, R., Mainde, U., Singh, A., Bhole, P., & Boddupalli, A. 2023. The Morphometrical and Histological Studies on The Pituitary Gland in Different Age Groups of goat (*Capra hircus*). *Indian Journal of Veterinary Anatomy*, *34*(2): 83-87.

Nickle, R., Schummer, A. and Seiferle, E. 1979. The Viscera of the Domestic Mammals.2nd Edn., Revised by Wolfgangottosack, Verlag paul parey Berlin, Hamburg.

Pai, J. and Pathak, M.M. 2005. Morphometrical observations of pituitary gland of Surti buffaloes during three phases of cycle for winter and summer seasons. *Indian Journal of Veterinary Anatomy. 17:*28-34.

Rao, A. K., Pathak, V., Rajput, R., Gupta, D. and Shukla, P. 2024. Morphological and Biometrical Study on the Hypophysis

Cerebri of Gaddi Goat in Different Seasons. *Indian Journal of Veterinary Anatomy. 35*(2): 139-142.

Snedecor, G.W. and Cochran, W.G. 1994. Statistical Methods. 8th Edn., Iowa State University Press, Ames, Iowa.

Vala, H., Rodrigo, J., Esteves, F., Santos, C., Cruz, R., Mega, C. and Nobreg, C. 2013. The Endocrine Glands in the Dog: From the Cell to Hormone. InTech. doi: 10.5772/ 53577

Ye, W., Wang, H., Wang, F. and Wang, J. 2018. Morphology and ultrastructure of the hypophysis in bactrian camels (*Camelus bactrianus*) *Int. J. Morphol.* 36:1316-1325.S