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## Gross morphological studies on the brain of Kadaknath fowl in growing period

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### Abstract

The present gross morphological study was carried out on the brain of six healthy birds of Kadaknath Fowl in growing period (7 weeks to 16 weeks). The birds were procured from the Central Poultry Development Organization (CPDO), Eastern Region, Bhubaneswar and the research work was conducted at Krishi Vigyan Kendra, Jharsuguda, OUAT. It was found that the brain of Kadaknath fowl subdivided into cerebrum, cerebellum and medulla oblongata. The cerebrum was by far the largest part of the brain, and it comprised of two symmetrical halves called cerebral hemispheres. The shape of cerebral hemispheres was almost similar to the shape of entire brain. The apparently closely apposed cerebral hemispheres were separated by a median (longitudinal) inter hemispheric fissure (groove). A small transverse fissure separated the cerebrum from the cerebellum. The gyri and sulci were absent in the cerebrum. On ventral surface, ill-developed olfactory lobes were observed anteriorly on either side of the median fissure. The mid brain blended directly with the medulla oblongata posteriorly. The medulla oblongata was almost occupied dorsally by the cerebellum.

**Keywords:** Brain, gross, grower, Kadaknath, morphology

### Introduction

Poultry production in India has emerged from an unscientific farming practice to commercial production system with state-of-the art technological inventions<sup>[11]</sup>. Little attention has been paid for indigenous chicken, due to its poor producing ability though there is enormous development in poultry industry<sup>[7]</sup>. Native indigenous poultry breeds contribute about 10 to 15% to the total poultry population of India. There are about 20 indigenous breeds of chicken found in India, so we need to conserve and improve their genetic resources. Out of many indigenous poultry breeds, Kadaknath or Kalamasi, the fowl having black flesh is an important indigenous breed of poultry found in vast areas of Western Madhya Pradesh mainly the Jhabua<sup>[3]</sup> and Dhar Districts and adjoining areas of Gujarat and Rajasthan. They are Jet black, pencilled and Golden Kadaknath are the three main varieties of Kadaknath breed<sup>[10]</sup>. It is locally known as "Kalamasi" due to its black flesh<sup>[8]</sup>. Most of the internal organs show the characteristic black pigmentation, more distinct in trachea, thoracic and abdominal air sacs, gonads, elastic arteries, at the base of the heart and mesentery. Blackish colouration is also found in the skeletal muscles, tendons, nerves, meninges, brain and bone marrow<sup>[4]</sup>. The study of brain can be related with the cognitive behaviour of the bird such as learning, memory, etc., which could be further explored by the neuro-anatomists. The present gross morphological study was carried out on the brain of Kadaknath fowl in growing period (7 weeks to 16 weeks) to establish a baseline data for this breed for future research.

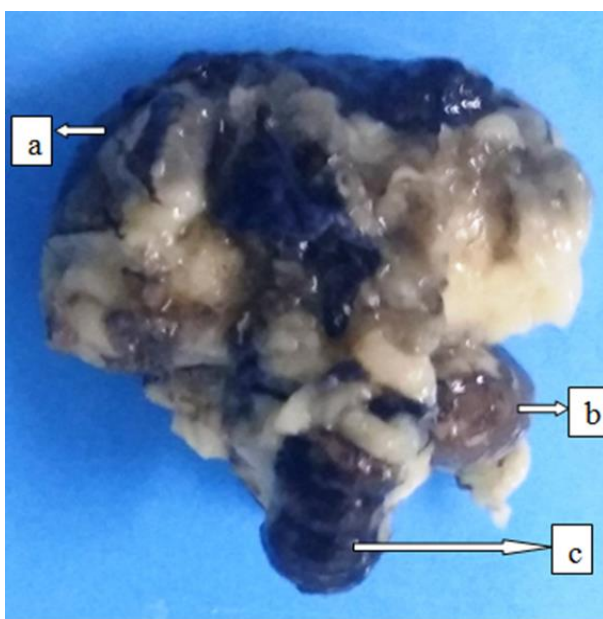
### Materials and methods

The Kadaknath chicks were obtained from the Central Poultry Development Organization (CPDO), Eastern Region, Bhubaneswar. The chicks were reared at KVK, Jharsuguda, OUAT and six healthy birds were selected from grower stage (7 weeks to 16 weeks) to study the gross morphological features of brain. The head of the birds were carefully removed at the level of second cervical vertebrae<sup>[9]</sup>. The cranial cavity was cut open by scissors, forceps and scalpel and nasal bones, temporal bones were severed by bone cutter rostrally and laterally up to the level of base of skull. Cranial nerve attachments were severed gently to remove the intact brain and thereafter the meninges were separated. The intact brain samples were washed in normal saline solution to study the detailed morphology.

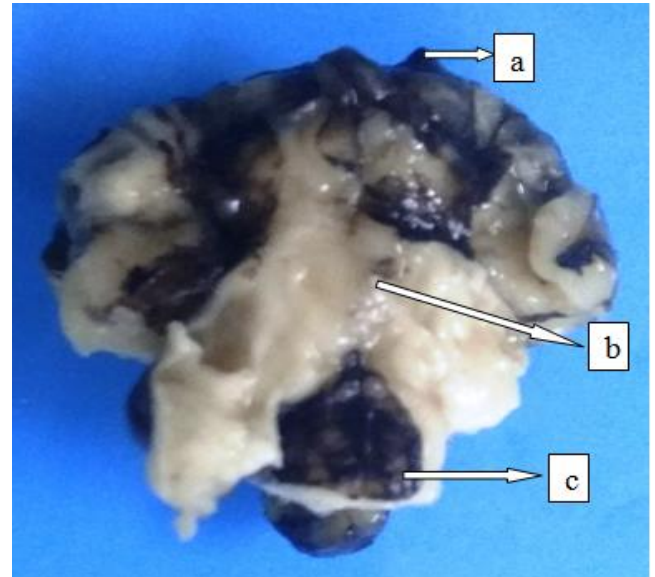
## Results and Discussion

The brain of Kadaknath fowl was pear shaped, which was in support with the previous observations made in locally bred chicken [2] and in barn owl [1]. The whole brain was subdivided into cerebrum, cerebellum and medulla oblongata (Fig. 1). The cerebrum was the largest part of the brain consisting of two symmetrical (right and left) halves called cerebral hemispheres. The cerebral hemispheres were pear shaped, i.e. they were broader in the middle and narrow at cranial and caudal ends, which were in support with the findings in white crested and uncrested chicken breeds [6]. Further, the shape of the cerebrum determined the shape of the brain [1, 2, 5]. The cerebral hemispheres were convex and smooth dorsally due to the absence of usual convolutions or elevations (gyri) and depression or grooves (sulci), which was similar to the findings reported in *Sturnus vulgaris* birds [5]. The cerebral hemispheres were separated by a median longitudinal inter hemispheric fissure. A transverse fissure separated the cerebral hemispheres from the cerebellum. The olfactory bulbs were ill-developed and present at the rostral pole of the cerebral hemispheres.

A small pineal body was present between the cerebral hemispheres at the caudal end of the longitudinal fissure in front of the cerebellum. Its stalk was narrow and attached with the roof of diencephalon. The cerebellum was large, laterally compressed and wedge-shaped located posterior to the cerebral hemispheres. The middle part was wider, but the ends were narrow. The cerebellum consisted of a central vermis lobe and two lateral cerebellar lobes. The surfaces of the lobes were subdivided into many folds by a number of transverse grooves or sulci called folia. The olfactory lobes were located anteriorly on either side of the median fissure in the ventral aspect (Fig. 2), which was similar to the finding of Frahm and Rehkamper [6] in white crested polish chicken. The optic chiasma was present just behind the caudal part of the median fissure. The optic lobes were large, spherical located one on each side the junction between the mid brain and hind brain. The mid brain blended with the medulla oblongata posteriorly. The medulla oblongata was present almost at the dorsal aspect of cerebellum.



**Fig 1:** Photograph of brain (Dorsal view) of Kadaknath fowl in grower period showing a) Cerebral hemisphere, b) Optic lobe and c) Middle vermis lobe of cerebellum



**Fig 2:** Photograph of brain (Ventral view) of Kadaknath fowl in grower period showing a) Olfactory lobe, b) Optic Chiasma and c) Medulla oblongata

## Conclusion

The present study would be helpful to the neuro-anatomists to investigate general principles of the nervous system with respect to development, behavior, physiology, anatomy and molecular biology. The avian models can be used to reveal many unknown facts of neuronal mechanism underlying various cognitive functions. The gross morphology of brain of Kadaknath fowl at grower period was successfully studied here. The baseline data developed could be useful for further research.

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