

Article

Preparation of indigenous duck (*Anas platyrhynchos*) skeleton to enhance veterinary anatomy teaching

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Abstract: The objective of this study was to prepare the skeletons of duck to enhance veterinary anatomy teaching. Five aged ducks were used in this experiment, which was collected from the Bangladesh Agricultural University poultry farm. The ducks were skinned and different segments of the body were dissected with the help of a scalpel. Then the bones were wrapped using merkin clothes, heated in 5% solution of soda water for 1 hour, and kept in that solution for 7 days for decomposing the muscles, tendon and ligaments. For proper cleaning, the bones were dipped into 10% bleaching water for 2 hours. After complete sundry, the bones were articulated using super glue for rising into a skeleton. The vertebral column was aligned with 25-gauge steel wire was inserted into the vertebral foramen. Finally, the skeletons were fixed on a wooden stand. Therefore, the skeletons were preserved and used for demonstration of osteology, and avian anatomy. This duck skeleton will be used to study avian morphology and make a comparative analysis with other mammals.

Keywords: Indigenous duck; skeleton; preparation; anatomy teaching

1. Introduction

The skeletons are a very essential part of the anatomy teaching and skeleton models are very important and basic in anatomy halls as well as museums to promote anatomy comprehension, which is considered the most important course in the preclinical stage. All the students were trained and experience through the teaching of anatomy course by employing the cognitive learning process (Bloom, 1956; Zaneb *et al.*, 2008). The skeleton is the framework of hard structure, which supports and protects the soft tissues of animals and birds (Getty, 1975). Skeleton gives students a “hands-on” method for learning bone names and locations, as well as a visual tool to relate bone and joint structure to muscle structure (Greene *et al.*, 1993). The requirement of the animal and bird skeleton is the basic need of the veterinary study in general and department of anatomy in particular. Skeletons (bones) are necessary for research ranging from phylogenies investigations to age and growth analyses to functional morphology (Bemis *et al.*, 2004; Olson, 1973; Burke, 1997).

Skeletons are preserved in museums, institutes, and organizations for the protection of nature and schools use skeleton in research and teaching (Bemis *et al.*, 2004). Skeletons are also used to identify animals and birds as well as in various forensic applications, such as the identification of carcasses of illegally taken animals and birds or, in rare cases, bones that have been taken as evidence in other crimes (Olson, 2003). Therefore, the necessity of preparing a skeleton of animals and birds is increasing rapidly. Presently, preparation of the skeleton is not practised at institute level due to procedural complexities. Preparation of skeleton of avian species and its exhibition may be interesting tools for teaching and education. Therefore, the purpose of this study was to simplify the procedure with the use of empirical methods for the preparation of duck skeleton and display for educational purposes. This will be helpful to improve veterinary anatomy teaching effectively in different institutions.

2. Materials and Methods

Five adult ducks were used in this experiment. The age of the ducks, were more than 4 years and collected from Bangladesh Agricultural University poultry farm.

2.1. Materials

The materials used for skeleton preparation were: (1) Wires of various gauges. (2) Varnish. (3) Wooden platforms. (4) Iron rods. (5) Good quality sticking materials (Fevibond/ Fevistic/ Flex quick).

2.2. Methods

The methods adopted in skeleton preparation were: (1) Skinning and defleshing, (2) Decomposing the muscles, tendon and ligaments, (3) Arrangement of bones, (4) Bleaching, (5) Drying of bones, (6) Varnishing of bones, and (7) Articulation of bones, (8) Positioning the skeleton

2.2.1. Preparation of the duck

The ducks were kept in fasting condition for 24 hours and then sacrificed with a sharp knife cut through the throat severing the carotid artery and the trachea.

2.2.2. Skinning and defleshing

Hot water was poured on the bird to facilitate the removal of the feathers from all parts of the body. Defleshing was done using a pair of scissors, forceps and a knife. The abdominal and thoracic cavities were open using the pair of scissors and forceps followed by the removal of GIT, respiratory, urinary, and reproductive organs by inserting the hand deep into the cavities and severing them from their point of attachments. Different segments of the bodies were wrapped in merkin clothes part by part to prevent loosing of small bones.

2.2.3. Decomposing the muscles, tendon and ligaments

The bones were boiled in 5% solution of soda water for 1 hour and kept in that solution for 7 days for decomposing the muscles, tendon and ligaments according to the concept of (Baker *et al.*, 2003; Van Cleave, 2010). The soda water solution was used for proper and complete digestion of muscles (Gofur *et al.*, 2010) and that will help to remove muscles and related structures easily.

2.2.4. Arrangement of bones

After 7 days later the bones were taken out and again the leftover flesh and tissue of the bones were scratched by the blade as maximum as possible. Then the ribs were gently pulled away from the backbone. The vertebrae and ribs were placed in order on a sheet. It was essential to keep the bones in order and in the exact position where the ribs attached along with the backbone. Then the bones were washed and cleaned by running tap water.

2.2.5. Bleaching

The bones were then dipped into 10% bleaching water solution for 2 hours to avoid further destruction of microorganisms.

2.2.6. Drying of bones

The moist bones were dried under the sun.

2.2.7. Articulation of bones

The bones were articulated and raised into the skeletons. Each pair of ribs was bound with the corresponding vertebra with the help of super glue. A long strong wire was inserted into the vertebral canals (skull to the coccygeal vertebral canal) so that it can support the weight of the skeleton. Each leg was framed separately and attached within position. The skull was articulated with the vertebral column to complete the skeleton.

2.2.8. Positioning the skeleton

Finally, the skeletons were mounted on wooden platforms of required dimension according to the size of the duck.

2.2.9. Varnishing of bones

Varnishing of the bones was done to improve the appearance of the skeleton.

3. Results and Discussion

The skeleton is composed of bones, cartilages and ligaments and is responsible for the maintenance of the shape flexibility as well as locomotion of the body (Ghosh, 2006). Formulation of the skeleton is very important for anatomical study. Adult and mature ducks were used in this experiment, to avoid the risk of softening and shrinkage of bones because boiling can shrink bones (Van Cleave, 2010). According to the objective of the study was to prepare a skeleton within a very short time and efficiently, after skinning as much flesh as possible were removed without risking damage to delicate parts of the skeleton. Once the crudely defleshed carcass was obtained, the next step was decomposing the carcass. It is usually done by remaining the carcass in a pit for 1-2 months, according to the size of the animals and birds (Raghavan, 1964). This process of skeleton preparation is time consuming, laborious and expensive also. As this process can easily be done even at home without full laboratory facilities by using proteolytic enzymes like neutrase and by using biological washing powders or meat tenderizers (Baker *et al.*, 2003) soda water was used to decompose carcass. Baker *et al.* (2003) and some other researchers do not recommend the use of biological washing powder to decompose carcass as it is corrosive and can damage bone but in this study, we used soda water as our aim was to prepare the skeleton quickly. Sodium hydroxide is frequently used in the process of decomposing roadkill dumped in landfills by animal disposal contractors (Leon *et al.*, 2014); on the other hand, use of proteolytic enzyme like neutrase is expensive (Baker *et al.*, 2003). The bones of the duck were boiled in 5% solution of soda water for 1 hour (Table 1) using a normal heater instead of an incubator and kept in that solution for 7 days for decomposing the muscles, tendon and ligaments. After 7 days of decomposing of the carcass, 4 hours' time was required for clearing the carcass (removing the tenderized meat over the bones) and then bleaching to avoid further decomposition by microorganisms because bones generally contain a lot of greases. The grease can cause problem such as over the years, grease can break down as a result of bacterial decay and the resulting acids attack the bones and the bones become unpleasant and smelly (Baker *et al.*, 2003). For this, the bones were dipped in 10% bleaching water solution for 2 hours (Table 1). After bleaching then the bones were dried absolutely by sun rays. As the objective was to save time, every process was finished very timely and quickly without wasting time and kept the bones less time in bleaching water solution. Then the bones were articulated to rise into skeletons and each skeleton was positioned on a suitable wooden base with the help of one rod and thick wire (Figures 1-8). Finally, all skeletons were housed in a display case. The duration of skeleton preparation (Table 1) indicated that the entire procedure took 4 days.

In this work, Bleaching processes using hydrogen peroxide 10% solution was suitable for getting better colour in a shorter time. (Greene *et al.*, 1993; Gram, 2006; Hussain *et al.*, 2007) used hydrogen peroxide 4% solution for the same process. Care must be taken for concentration and timing because the results showed that increasing timing and concentration of the Hydrogen peroxide led to crumbling (Hussain *et al.*, 2007).

The present study revealed that the preservation technique of the skeleton model of duck might improve the teaching of anatomy courses and enrichment of the anatomy museums with bird skeleton models. This study revealed that there were eight steps of preservation technique of skeleton models, including skinning and defleshing, decomposing, arrangement of bones, bleaching, drying, varnishing of bones, articulation of bones and positioning the skeleton.

Table 1. Steps for preparing the skeleton of ducks.

Steps	Required time	
Skinning and defleshing	As quick as possible	
Decomposing carcass	Boiling	1 hour
	Cooling	2 hours
Clearing	4 hours	
Bleaching	2 hours	
Drying	3 days	
Varnishing	1 hour	
Articulation of Bones	As the time required	
Positioning the skeleton	2 hours	



Figure 1. Skinning of the duck.



Figure 2. Defleshing of the duck.



Figure 3. Boiling of bones.



Figure 4. Cleaning of bones.



Figure 5. Drying of bones.



Figure 6. Articulation of bones.



Figure 7. Lateral view of the duck skeleton.



Figure 8. Craniolateral view of the duck skeleton.

4. Conclusions

The study has also established the local and cheaper pattern of preparation of the duck for the study, which did not involve many laboratory chemicals. Finally, the study helped in developing and improving the skeleton model technique for learning the anatomy of veterinary medicine.

Conflict of interest

None to declare.

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