The Discovery of a Bone in the Anterior Fontanelle of the Skull of the Sheep (Ovis aries)

Descubrimiento de un Hueso en la Fontanela Anterior del Cráneo de la Oveja (Ovis aries)

Shaibu Mohammed Atabo1,2; Abubakar Abubakar Umar3; Sani Abdullahi Shehu1,2,3 & Adamu Abdul Abubakar4,5

INTRODUCTION

Balami, Uda and Yankasa are the three most common breeds of sheep in Nigeria. The Balami breed is the largest bodied predominantly found in the northeastern region of Nigeria, it is predominantly white and hairy, with a strongly convex face. The ear is large and pendulous. The tail is thin and long. Horns are prominent in rams but absent in the ewes (Popoola & Oseni, 2018). Mature weight is 40 to 65 kg in males and 30 to 45 kg in females. The Uda breed of sheep is a large but slightly smaller than the Balami; it is long-legged with a convex face (Yakubu & Ibrahim, 2011). The breed has a characteristic coat-colour pattern. The anterior (fore) half is black or brown while the posterior (rear) half is white. The ear is long and pendulous, they predominant in the northwestern part of Nigeria. The Uda rams carry horns that became larger, wide and spiral as they mature. Horns are usually absent in the females. Mature live-weight are 30 to 45kg in females and 30 to 60 kg in males. (Yakubu & Akinyemi, 2010; Yakubu & Ibrahim, 2011). The Yankasa sheep is intermediate in size. It has a typical white coat-colour with dwarf patches around the eyes, ears, muzzle and sometimes feet, and they common in the northcentral part of Nigeria (Yakubu & Akinyemi, 2010; Yakubu & Ibrahim, 2011).

Popoola & Oseni (2018) classified Nigerian indigenous breeds of sheep based on their head conformation using multivariate analyses. The skeleton of the head (skull) is the most important complexly organized group of bones. Skull as a whole has three surfaces; dorsal surface, lateral surface (the skull-Orbit), and ventral surface of the skull. The bones of the skull are divided into two parts; the cranial (neurocranial) bones and facial (viscerocranial) bones. The neurocranial bones are the occipital, interparietal, parietal, frontal, temporal, sphenoid and ethmoid bones whereas the viscerocranial bones are maxilla, incisive (premaxilla), palatine, pterygoid, nasal, lacrimal, zygomatic (malar), vomer, turbinates, and mandible (Dyce et al., 2017). The skull is a flat bone that is relatively thin and expanded in two dimensions which provides protection for the brain and the organs of special senses (eyes, nose, ears and tongue) hence the need to study it.

Skull morphology is an important criterion in the assessment of species and breeds of animals and their genetic profiles (Shawulu et al., 2011). Künzel et al. (2003) also reported that the morphological studies of the skull are vital...
in classification as phenotypic appearance of an animal’s head depends on the skull and is strongly related to breed-specific skeletal features. These parameters can also be a basis for the study of interactions between heredity and environment (Onar, 2001). Osteomorphometric studies of the skull have been documented in adult/postnatal sheep across some regions of the world such as Kosovo Bardhoka sheep (Gündemir et al., 2020), Chilean Suffolk Down sheep (de la Barra et al., 2019), Indian Madras Red sheep (Sundaram et al., 2019), Iraqi Indigenous sheep (Ahmed & Mahmood, 2018), Iranian Zell (Thin-tailed) sheep (Abbasabadi et al., 2020), Iranian Mehraban sheep (Dalga et al., 2018), Indian Jammu sheep (Sarma et al., 2007), Polish Heath sheep (Baranowski, 2017), Spanish sheep (Martín & García-Gonzalez, 2015), Spanish Xisqueta (Parés I Casanova et al., 2010), Iranian Afshari sheep (Masoudifard et al., 2008). Except for the work done by Atabo (2021) and Ahmad (2008), there is a paucity of information on prenatal and postnatal developmental morphological studies of the skull in sheep in Nigeria. In an effort to provide baseline data on the developmental morphology of the skull of sheep, morphological studies of the skull of sheep breeds in Nigeria were carried out and hereby report unique finding observed in the study.

MATERIAL AND METHOD

A total of 270 sheep heads of three (3) prenatal age groups consisting of 90 each of Balami, Uda and Yankasa breeds (Table I) and 750 sheep heads of five (5) postnatal age groups, consisting of 250 each of Balami, Uda and Yankasa Nigerian breeds of sheep (Table II) obtained from the slaughtered animals from in the Nigerian abattoirs were used for this study. The heads were macerated using the methods described by Atabo (2021). A study involving the comparative developmental morphology of the skulls of the three breeds was performed. The study was approved by the Institutional Animal Care and Use Committee (IACUC) of the Usman Danfodiyo University Sokoto with the reference no. UDUS/FAREC/2019/AUP-RO-5.

RESULTS

A bone was found at the centre of the anterior fontanelle at birth (postnatal stage), the bone was roughly circular and absent in the prenatal/fetal stages (Figs. 1 to 3). The bone was peculiar to both sexes of Yankasa breeds and absent in all the prenatal and postnatal developmental morphological studies of the skull in sheep in Nigeria. In an effort to provide baseline data on the developmental morphology of the skull of sheep, morphological studies of the skull of sheep breeds in Nigeria was carried out and hereby report unique finding observed in the study.

Table I. Number of prenatal/fetal samples collected per breed of sheep.

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Balami</th>
<th>Uda</th>
<th>Yankasa</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; trimester</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; trimester</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; trimester</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>270</td>
</tr>
</tbody>
</table>

Table II. Number of postnatal samples per breed of sheep.

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Balami</th>
<th>Uda</th>
<th>Yankasa</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day-old</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>6 months</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>1 year</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>150</td>
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<tr>
<td>2 years</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>3 years</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Total</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>750</td>
</tr>
</tbody>
</table>

Fig. 1. 2nd trimester nuchal view of the Yankasa fetus showing; the frontal bone (1), centre of the anterior fontanelle (2), parietal bone (3), occipital bone (4), and occipital condyle (5).
Fig. 2. 3rd trimester nuchal view of the Uda (A) and Yankasa (B) fetus showing; the frontal bone (1), centre of the anterior fontanelle (2), parietal bone (3), interparietal bone (4), occipital bone (5) and occipital condyle (6).

Fig. 3. The nuchal view of a day-old Yankasa fetus showing; the frontal bone (1), roughly circular anterior fontanelle bone (2) parietal bone (3), interparietal bone (4), occipital bone (5), external occipital protuberance (6) and occipital condyle (7).

Fig. 4. The nuchal surface of a 1-year old skull of a male Yankasa sheep showing the frontal bone (1), roughly circular anterior fontanelle bone (2), parietal bone (3), interparietal suture (4) and occipital bone (5).

Fig. 5. Nuchal surface of the skull in female Yankasa showing; Frontal bone (1), centre of the anterior fontanelle (2), Parietal bone (3), interparietal part of occipital bone (4), occipital squama (5) occipital condyles (6) and paracondylar process (7).
DISCUSSION

It was documented that the number of the neurocranial and viscerocranium bones of the ovine species and other ruminants was 7 and 9 respectively (Choudhary & Singh, 2016; Dyce et al., 2017; Atabo et al., 2021). This study has further confirmed the presence of 7 and 9 neurocranial and viscerocranium bones of the sheep skulls respectively, however, the young Yankasa had an 8th neurocranial (the circular bone) found at the centre of the anterior fontanelle, while the Balami and Uda had the usual 7 neurocranial bones namely; occipital, interparietal, parietal, frontal, temporal, sphenoid and ethmoid bones. This 8th neurocranial in the Yankasa breeds of sheep in this study has to the best of our knowledge, not been reported before in the literature and thus, its clinical significance is yet to be known. A comparison with museum specimens however revealed that this circular bone was not seen in goat, cattle, dog, pig and man but it is present and well defined in young Yankasa breeds of sheep.

This small, roughly circular bone discovered at the centre of the anterior fontanelle of young Yankasa breed can be an aid in distinguishing the Yankasa breed from Balami, Uda, other breeds of sheep and species of animals, since a search of the literature yielded no information on this circular bone in the skull (anterior fontanelle) of any species of animals. Consequently, we venture to name this bone, the antero-fontanelle bone (of Atabo).


Corresponding author:
Atabo, Shaibu Mohammed (D.V.M., M.Sc., Ph.D.)
Department of Veterinary Anatomy
Faculty of Veterinary Medicine
Bayero University
Kano - NIGERIA

E-mail: mohakosh@yahoo.com
smatabo.van@buk.edu.ng

REFERENCES