

# Caudo-Frontal Depression: A Landmark for Local Anasthesia in the Dehorning of Sahel Goats (*Capra hircus*)

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With 2 figures and 2 tables

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## Abstract

The variation in shape and morphology of the head among animals even within the same family is common. Work to determine skull shape have been carried out by some workers. In horned animals, the position of the horns may differ and therefore necessitate the exploration of land marks for local anaesthesia.

The caudofrontal depression of Sahel goats was studied to ascertain its involvement as a possible landmark for the deposition of local anaesthetic substances during dehorning process in this breed. The location of the depression was seen to be along the temporal crest, dorsal to the temporal fossa between the eye orbit and the horns. Data obtained indicates that it has a breadth of  $1.01 \pm 0.09$ cm at the left side and of  $0.97 \pm 0.14$ cm at the right side in

female animals. Males had  $0.84 \pm 0.04$ cm at the left and  $0.85 \pm 0.13$ cm at the right side with a significant difference ( $p = 0.0074$ ) between them. The mean distance of the depression from the orbital margins were both higher in the female ( $1.08 \pm 0.17$ cm for the left and  $1.01 \pm 0.16$ cm for the right). Males had mean distance of  $1.04 \pm 0.20$ cm and  $0.99 \pm 0.20$ cm respectively. It was also discovered to be about half way (range 39.13% – 45.42%) the distance to the horn in the female and (range 21.14% - 24.12%) in the male. The depression was shallow but forms the region of the passage for the cornual nerve branch of the infratrochlear nerve as well as the superficial temporal artery branch supplying the horn. There was no significant difference in its entirety and has no sexual dimorphic features. It was thus concluded to be prescribed as a land-

mark for direct targeting of the infratrochlear cornual nerves and in the total elimination of blood loss from the superficial temporal artery during dehorning of the Sahel goats.

**Keywords:** caudofrontal depression, landmark, local anaesthesia, dehorning, Sahel goats.

## Introduction

Sahel goats are predominantly horned ruminants that are widely spread across the sub-Saharan region of Africa (Gall, 1996). In Nigeria, they are found predominantly in the northeastern part of the country (Gall, 1996; Kwari *et al.*, 2004). They are easily identified by some striking features one of which is the curved or twisted horns (Mason and Maule, 1960). The position of the horns at the dorsal profile of the skull is sharply sloping towards the nuchal plane (Sivachelvan *et al.*, 1995). The sizes and lengths of these horns are variable, diverging outwardly (Gall, 1996; Dyce *et al.*, 1996). Horns are known for defense under fright conditions by horned animals. In some species, it is used in ageing processes of adult animals (Aspinall, 1976). In several cases overgrown horns may pose threat to the animal itself, danger to handlers and posses some risk of interference from dominant animals

that may bully other animal during feeding or on the farm. This necessitates removal of the horns after they have formed from the horn bud. Physical methods of dehorning (gouge dehorning) include the use of embryotomy wire, guillotine shears, or dehorning knives, saws, spoons, cups, or tubes (AVMA, 2011). Dehorning is also done for cosmetics purposes and most importantly to improve the productivity of such animals. In most cases dehorning is associated with severe pain and therefore necessitates desensitization. The presence of the cornual diverticulum of the frontal sinus causes surgical dehorning of adult to be more invasive (La Fontaine, 1975; Ward and Rebhun, 1992). A recent finding (Olopade *et al.*, 2006), revealed that the caudofrontal depression exist at the temporal bone equidistant from the zygomatic process of the frontal bone and the base of the horn in Sahel goats. The functional indication of this depression was however not reported in any literature.

The cornual nerve, a branch of the infratrochlear and lacrimal (zygomaticotemporal) nerve, provides sensation to the skin around the base of the horn in goats and sheep (Butler, 1967). The infiltration of a local anesthetic substance around the cornual nerve as it traverses the frontal crest will desensitize the area

(Hoffis, 1995; Godinho and Getty, 1975). Although in practice, local anaesthesia of goat was possible, many surgeons admitted to the difficulties experienced in achieving it. In most developed Countries, Veterinary surgeons dehorn or disbud goats under general anaesthesia (). However, the use of general anaesthesia on the farm was regarded as impracticable because of the care and attention required during post-anaesthesia recovery (Taylor, 1991; Flecknell, 1991). This necessitates the careful and accurate applications of the local anaesthesia. A precise knowledge of the location of reference points in this area provides important data in local anaesthesia.

This study was carried out to ascertain the extent of the depression and its indication as a landmark for cornual nerve block or anesthetic application in the dehorning of Sahel goats.

## Material and Methods

A total of 27 Sahel goat heads were used, measurements were carried out in 17 skulls in this study. The goats were first screened for physical deformities involving the head and aged by the dentition method described by Sissons and Grossman (1975).

### **Skull processing and cleaning**

The skin and muscles around the skull were gently removed. Tissues around the depression were carefully excised preserving blood vessels and nerves emanating from the temporal fossa. The skulls were thereafter macerated by boiling, a technique described by Onar (1999) and Olopade and Onwuka (2005). Skulls were air dried and the depression studied by physical examination.

### **Measurements**

Measurement was taken from 17 skulls comprising 7 males and 10 females using a vernier caliper Silverline<sup>®</sup> with a minimum scale of 0.02mm-0.001".

The indices measured are;

1. Distance from the neck of the horn to the margin of the depression (T)
2. The breadth of caudofrontal depression (CD)
3. The distance from the depression to the margin of the orbital circumference (OD)

The data obtained were analysed with a Graph pad InStat<sup>®</sup> prism, a soft ware for statistical analysis of raw data from the Gaussian distributions using the method of Kolmogorov and Smirnov. The result was presented as mean  $\pm$ SD values.

## Results

The result (Table 1) shows that females had higher bilateral depression breadth of  $1.01 \pm 0.09$ cm at the left side and of  $0.97 \pm 0.14$ cm at the right side. Males had  $0.84 \pm 0.04$ cm at the left and  $0.85 \pm 0.13$ cm at the right side with a significant difference ( $p = 0.0074$ ) between them. The distance of the depression to the orbital margins were both higher in the female ( $1.08 \pm 0.17$ cm for the left and  $1.01 \pm 0.16$ cm for the right). Males had  $1.04 \pm 0.20$ cm and  $0.99 \pm 0.20$ cm respectively. The distance between the depression and the neck of the horns were  $0.53 \pm 0.10$ cm and  $0.56 \pm 0.15$ cm in the female, while male had  $0.49 \pm 0.12$ cm and  $0.59 \pm 0.10$ cm respectively which are insignificantly lower than those of the females. The location of the depression from the eye orbit is about half the entire length to the horns obtained both in males and females (range 39.13% – 45.42%) (Table2). The distance to the neck of the horns was less obtained from the percentile mean distance (range 21.14% - 24.12%). The depression lies along the temporal crest, dorsal to the temporal fossa. Because of its oval outline (fig 1) it limits the parietofrontal suture. It is shallow and forms passages for cornual nerve branch of the infratrochlear nerve and the

branch of the superficial temporal artery to the horn (fig 2). The cornual nerve branch of the infratrochlear nerve runs backward from the eye orbit to the horn (fig. 3). The differences observed between the male and the female does not show any significant differences to depict sexual dimorphism.

## Discussion

The shape and the appearance of the head are very important in determining the character of an animal (Dyce *et. al.*, 1996) and in the de-horning process of horned animals (Buttle *et. al.*, 1986). The gross morphology of this region shows clearly blood supply through the temporal arterial branch of the zygomaticotemporal artery and nerve innervations to the tissues around the horns (Sissons and Grossman, 1975). The findings also concur with the report that nerve supply to the horn region in the goat and sheep is via the cornual branches of the lachrymal (zygomaticotemporal) and infratrochlear nerves (Butler, 1967). Both of these nerves must be blocked prior to dehorning. It also concur with the report of Bourne, (2011), Vitums (1954) that infratrochlear nerve block is achieved at the dorso-medial margin of the orbit and that it can be done half way the distance between the eye

and the horn (Jenkins, 1986); the nerve may be palpable as it emerges under the skin to innervate the horn. It is however less so in polled animals (Sissons and Grossman, 1975).

The involvement of the depression was never reported in any available literature as well as the cornual nerve and vessels emanating from the temporal fossa to the horns. A comparison with museum specimens of horned animals however revealed the absence of this depression in the cattle, antelope but appears far less distinct in the sheep. However, Olopade *et al.*, (2006) observed the existence of this depression in the three major breed (Sahel, Maradi and West African dwarf goats) of goats in Nigeria. All these breeds of goats spread across the sub-Saharan Africa as reported by Gall, (1996). Dehorning of goats on farm is not practicable under general anaesthesia (FAWC, 1980). Hence, local anaesthesia application is carried out by targeting the cornual nerves and then after anaesthetizing them. The corneal nerve branch of the infratrochlear nerve runs backward from the eye orbit as reported by Edwards (2001) in cattle. Morphological landmarks have been used in physical examination and are necessary in clinical applications of anaesthesia in surgical operations such as dehorning

(Machen *et al.*, 2008; Buttle *et al.*, 1986). Dehorning should be performed under a local anesthetic and the animal monitored for hemorrhage and infection (AACG, 1988). This is to reduce the post-surgical care a dehorn animal might require on the farm. Several different methods can be used to dehorn animals (Ensminger, 1980; Etgen, *et al.*, 1987). These include chemical treatments, such as calcium chloride injections and caustic sticks; cutting instruments such as dehorning tubes, gouge dehorner, saws, and Barnes dehorner; and also electrical dehorner. Dehorning by these methods is accomplished by eliminating the blood supply to the horn tissue. If the blood supply is not totally eliminated, partial or complete horn re-growth can occur. This work is believed to aid the dehorning process of Sahel goats by prescribing landmark for direct targeting of the infratrochlear cornual nerves and in the total elimination of blood loss during dehorning of the Sahel goats.

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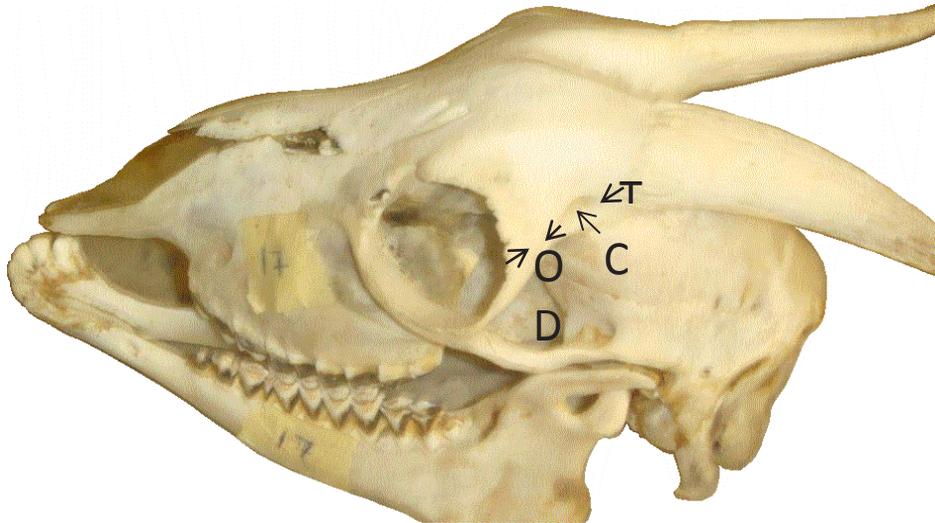
**Table (1):** Mean± SD width of the depression, distance to the base of the horn and from orbital margin

Parameters	Breadth of depression (CD) (cm)		Distance to the orbital margin (OD) (cm)		Distance to the neck of the horn (T) (cm)	
	L	R	L	R	L	R
Male n= 7	0.84±0.04	0.85±0.13*	1.04±0.20	0.99±0.20	0.49±0.12	0.59±0.10
Female n= 10	1.01±0.09	0.97±0.14	1.08±0.17	1.01±0.16	0.53±0.10	0.56±0.15

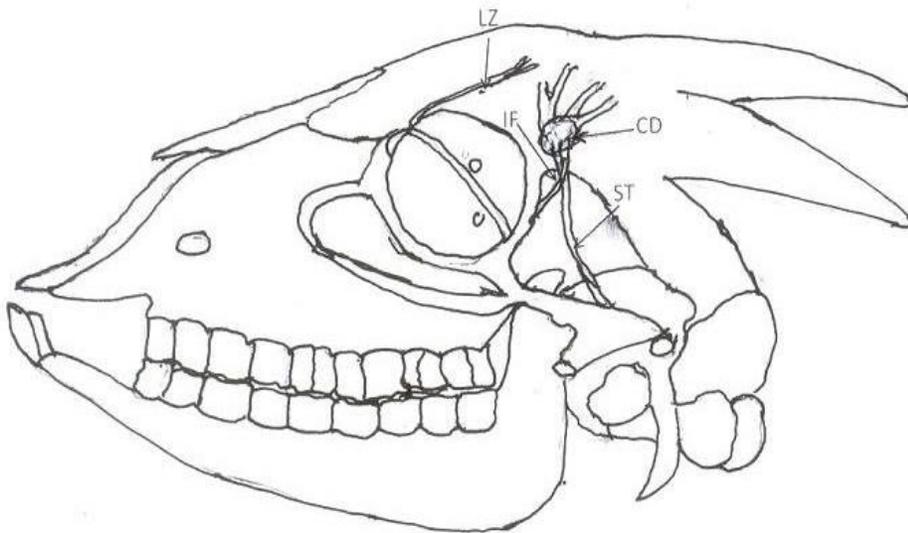
\*p = 0.0074.

**Table (2):** Mean percentile values of parameters

Parameters	Breadth of depression (CD) (%)		Distance to the orbital margin (OD) (%)		Distance to the neck Of the horn (T) (%)	
	L	R	L	R	L	R
Male n= 7	32.23 (%)	34.27 (%)	45.42 (%)	41.61 (%)	22.34 (%)	24.12 (%)
Female n= 10	36.91 (%)	37.12 (%)	41.95 (%)	39.13 (%)	21.14 (%)	23.75 (%)



**Fig (1):** The skull of the Sahel goat showing the caudofrontal depression (Cd), distance from the eye orbit (OD) and the distance to the neck of the horn (T).



**Fig (2):** Schematic diagram of the Sahel goat skull depicting the nerve and blood supplies to the horns (LZ) lacrimozygomatic nerve (IF) infratrochlear nerve, (ST) superficial temporal artery and (CD) caudofrontal depression.