NSAP 47th Annual Conference (JOS 2022) CONFERENCE PROCEEDINGS
THEME: SECURING ANIMAL AGRICULTURE AMIDST GLOBAL CHALLENGES

GROSS ANATOMICAL STUDIES ON THE ISTHMUS AND ACCESSORY STRUCTURE OF THYROID GLAND IN RED SOKOTO AND SAHEL GOATS

Mahmud, M.A.[1]*, Shehu, S.A.[2], Umar, A.A.[2], Jibril, A.[3], Danmaigoro, A.[2], Abdulsalam, W.[1], Ahmad, A.M .[4]

[1]*Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, Niger State, Nigeria*

[2]*Department of Veterinary Anatomy, Usmanu Danfodiyo University, Sokoto, Nigeria.*

[3]*Department of Theriogenology and Animal Production, Usmanu Danfodiyo University, Sokoto, Nigeria*

[4]*Department of Pre-ND Science, Niger State College of Agriculture, Mokwa, Nigeria*

***Corresponding author's Email and Telephone: drmahmud2@gmail.com; +2348036347603**

ABSTRACT

The present study is conducted to compare the gross morphology of the isthmus and accessory structure of thyroid gland in Red Sokoto Goats (RSG) and Sahel Goats (SG) at both prenatal and postnatal stages of development. A total of 90 fetuses and 60 heads and necks of postnatal goats were collected from the slaughter slabs of Batta and Ilella in Sokoto State and the Kano Central Abattoir in Kano State. The fetuses were divided into 3 groups according to their ages (1st trimester, 2nd trimester and 3rd trimester) on the basis of Curved Vertebral-Rump Length (CRL) while those of the postnatal were also divided into three age groups; Group I (Prepubertal Age), Group II (Pubertal Age) and Group III (Adult Stage). The features noted were location, shape and colour of the isthmus and accessory structure of the thyroid glands. Gross morphology of the Isthmus in RSG and SG are as in most other domestic mammals. The accessory structure of the thyroid gland was observed only on the left lobe of two subjects in the SG. One at the third trimester and the other one at the Adult age in the male group. The isthmus which connected the thyroid lobes either horizontally or diagonally was inconsistently present in all ages of both breeds. Based on the findings of the present study, it may be assumed that accessory gland tissue may not be a common developmental anomaly amongst RSG as compared to SG.

Key words: Gross anatomy, Prenatal, Postnatal, Thyroid Gland, Sahel Goats, Red Sokoto Goats

INTRODUCTION

The thyroid gland is the largest and the first recognizable endocrine gland during development in vertebrates (Hossam et al., 2012). The thyroid gland is a highly vascularised endocrine organ and it is normally made up of two lobes, joined by an isthmus. These lobes are asymmetrically situated on either side of the trachea close to the thyroid cartilage of the larynx (Frandson *et al*., 2003). In rare cases, the lobes are situated symmetrically on either side of the trachea (Hamad, 2008). An accessory lobe is sometimes seen in the dog, sheep, goat and camel (Taha and Abdel-Magied, 1994). Thyroid hormones have been found to influence reproduction, growth, milk and fiber properties of domestic animals (Todini, 2007). Marked variations in location, gross and histological features of the thyroid gland have been observed in different vertebrates (Dyce *et al*., 2010). Therefore, the present study was conducted to compare the gross morphology of the isthmus and accessory structure of thyroid gland in Red Sokoto goats and Sahel goats at both prenatal and postnatal stages of development.

Materials and Methods

A total of 90 fetuses {45 from each breed; 15 per trimester; identified based on phenotypic characteristics as described by Ngere *et al*. (1984)} and a total of 60 heads of postnatal goats (30 from each breed; 10 per age group) were collected from the slaughter slabs of Batta and Ilella in Sokoto State and the Kano Central Abattoir in Kano State, after obtaining approval from the Institutional Animal Care and Use Committee (IACUC) of Usmanu Danfodiyo University, Sokoto (IACUC/UDUS/2020/AUP-RO-4). They were taken to the Veterinary Anatomy Laboratory, Usmanu Danfodiyo University, Sokoto inside jars filled with 10%

neutral formalin. With the aid of a rule (butterfly), the curved crown-to-rump length (CRL) of the fetuses was measured in cm. The ages were then estimated biometrically using the prediction formula in prenatal goats: Y= (CRL+17) 2.1, where Y is the age (days) and CRL = Crown–to-Rump Length (cm) and visual observation of developmental features (Malik *et al*., 1997). The biometric categorization of the fetus into trimesters was done based on morphological ageing as described by Gall *et al*. (1994) into: Group I (First Trimester; 0-51 days of Gestation), Group II (second Trimester; 52-102 days of Gestation) and Group III (third Trimester; 103-153 days of Gestation). Ageing and grouping of postnatal goats were determined by dentition method as outlined by Umar *et al*. (2018) and divided into three age groups as outlined by Srinivas (2013) into Group I (0-3 months of age; Prepubertal Age)**,** Group II (3-12 months of age; Pubertal Age) and Group III (12-36 months of age; Adult Stage). The modified method by Chibuzor (2006) was used for the dissection. The features noted were location, shape (lobation), and colour of the thyroid glands**.** The thyroid glands were then photographed using digital camera (Samsung ES95, 18.2 megapixels). The topographical relationships of the two thyroid lobes with surrounding structures were also noted.

RESULTS AND DISCUSSION

The isthmus, a thin filament which connects two lobes of the thyroid gland (Plates 1, 2, 3, 4 & 5), was consistently present in both breeds as from second trimester with varied thickness, giving the two lobes an inverted "U" shaped appearance at their caudal ends. This similar observation was also made by Igbokwe and Ezeasor (2017) in West African Dwarf goat. In the first trimester, it was present in some goats, though very faintly (Plate 1). The two lobes were connected by isthmus around the ventral aspect of the trachea with varied positions. In some goats of both breeds, the isthmus connected the thyroid lobes horizontally while in some, it connected the lobes diagonally (Plate 6). These were seen all the ages except in very few goats. Where the isthmus of the fetuses connected the lobes horizontally, it was mostly seen to be placed between 3rd to 5th tracheal rings in RSG while in SG it was placed at the 4th to 6th tracheal ring. At postnatal groups, it was placed horizontally between 6th to 7th tracheal rings in both breeds. For the diagonally placed isthmus, the number of its tracheal rings of connection to either left or right lobes varied in both breeds across the age groups. For instance, in some males of Pubertal age group of SG, the isthmus connected to the left lobe at 8th tracheal ring while it connected to the right lobe at 5th tracheal ring. The isthmus appeared long and wide or thin in some goats while in some, it appeared short and narrow or thin. The substance of the isthmus appeared to be a strand of fibrous connective tissue in goats older than 12 months age groups of RSG than in the same group of SG. The colour of the isthmus in both breeds across all age groups varied among dark-red, yellowish brown and fibrous white. In the present study, the isthmus was absent in very few goats. This observation was in consonance with the reports of Muktyaz *et al.* (2013) in 12.5% human beings and Joshi (2016) in three out of forty adult goats. The present study was in contrast to the observations of Saad (2015) who found isthmus always present in adult goats, Roy *et al*. (1975) who failed to find thyroid isthmus in all goats studied. The absence of thyroid isthmus can be associated with several thyroid developmental anomalies (Duh *et al*., 1994) and is therefore a mal-developmental finding in this present study. In the present study, the substance of the isthmus appeared to be an indistinct strand of fibrous connective tissue in some subjects. This is in disagreement with the previous studies of, Getty (1975) in foal, sheep and ox. He noted that the isthmus was more distinct and glandular. This difference could be due species or genetic variations. The accessory thyroid gland was not observed in all ages of the Red Sokoto Goat (RSG). A similar finding of the absence of the accessory thyroid gland in all ages of the RSG was also found by Igbokwe and Ezeasor (2017) in West African Dwarf goats. However, it was observed on the left lobe of two subjects in the SG; one at the third trimester (Plate 6) and the other one at the Adult age in the male group (Plate 7). Contrary to the observations of Saad (2015), Joshi (2016), Igbokwe and Ezeasor (2017) in goats. The accessory lobe was observed on the left lobe of two subjects in the SG and it appeared as an extension of the caudal extremity. This result is in conformity with the earlier reports of Baishya *et al.* (1985) in goats. The accessory thyroid gland appeared in those left lobes as an extension of the caudal extremity. Taha and Abdel-Magied (1994) have shown that the accessory thyroid lobe appears as an extension of the caudal extremity of one of the two lobes. Carcangiu (2007) described further that accessory thyroid tissue can be found in the vicinity of the thyroid gland, in the region of the

hyoid bone, within the thymus, along the entire cervical portion of the trachea, between the mediastinal pleurae, within the pericardium in aortic arch region, embedded in the periaortic fat, and suspended cardially in the conus arteriosus.

CONCLUSION

The isthmus which connected the thyroid lobes either horizontally or diagonally was inconsistently present in all ages of both breeds. Based on the present study, it may be assumed that accessory gland tissue may not be a common developmental anomaly amongst the RSG as compared to SG.

REFERENCES

Carcangiu, M. I (2007): Thyroid. In: Histology for pathologists (ed. Mills, S.E) 3rd edition, Philadelphia, Lippincott-Williams and Wilkins Publishers, pp. 3402-3445.

Chibuzo, G.A. (2006). The teeth in: Ruminant dissection guide. A regional approach in goats, 2nd revised ed. Beth-Bekka Academic Publishers, Maiduguri, Nigeria, pp.59-61.

Duh, Q.Y., Ciula, T.A. and Clark, O.H. (1994). Primary parathyroid hyperplasia associated with thyroid hemiagenesis and agenesis of the isthmus. *Surgery*, 115: 257-263.

Dyce, K.M., Sack, W.O. and Wensing, C.J.G. (2010). Textbook of Veterinary Anatomy. 4th edition. W.B. Saunders Company, USA. Pp: 714-720.

Frandson, R. D., Leewilke, W. and Deefails, A. (2003). Anatomy and Physiology of Farm Animals. 7th edition, IOWA, USA,Wiley-Blackwell. pp.218.

Gall, C. F., Stier, C. H. and Frahm, K. (1994). Age estimation of Yankasa sheep fetus. *Small Ruminant Res*, 14: 91-94.

Getty, R. (1975). Sisson and Grossman's The Anatomy of the Domestic Animals. Vol.2, W.B. Saunders Company Philadelphia. London, Toronto. Pp 151-153 and 558-563.

Hamad, E. S. A. (2008). Seasonal changes in the morphology and morphometry of thyroid gland of the Nubian goat. M.V. Sc Thesis, University of Khartoum.

Hossam, H. A., Mohammad M. A., Mona S. Z. and Gamal F. M. (2012). Effect of seasonal temperature changes on thyroid structure and hormones secretion of white grouper (*Epinephelus Aeneus*) in Suez Gulf. Egypt. *Life Science Journal,***9**(2): 700-705.

Igbokwe, C.O. and Eseazor, D. N. (2017). Age-related Microscopic Changes in the Thyroid Gland of West African Dwarf Goat during Foetal and Post-natal Periods of Development. *Not Science of Biology*, **9**(1):59-66.

Joshi, S. (2016). Gross and Histological studies on the thyroid gland of goat (*Capra hircus*). PhD Thesis. Rajasthan University of Veterinary and Animal Science, Bikaner, India.

Kaur, H. S., Kumar, U., Bajwa, S. J. S. and Kalyan, G. S. (2013). Absent thyroid isthmus: embryological and clinical implications of a rare variation of thyroid gland revisited. *Thyroid Research and Practice*, 10 (2): 80-82.

Malik, M. R., Parmar, M. L. and Pillai, P. V. A. (1997). Prenatal growth changes of thyroid gland in goats. *Indian Journal of Animal Sciences,* 67 (9): 774-776.

Muktyaz, H., Yadav, B., Saxena, D. and Sharma, K. A. (2013). Anatomical variations of thyroid gland and its clinical significance in north indian population. *Global Journal of Biology, Agriculture & Health Sciences*, 2 (2): 12-16.

Ngere, L.P., Adu, I.F. and Okubanjo, O. (1984). The indigenous goats of Nigeria. *Animal Genetics Research and Information,* 3: 1-9.

Roy, K. S., Saigal, R. P. and Nanda, B. S. (1975). Gross, histomorphological and histochemical changes in the thyroid gland of goat with age. I. Gross and biometry study. *Anat. Anz*., **137**: 479-435.

Saad, E. (2015). Seasonal Changes in the Morphology and Morphometry of the Thyroid Gland of the Nubian Goat. M.V.Sc Thesis, Faculty of Veterinary Medicine University of Khartoum, Sudan.

Srinivas, P. (2012). *Veterinary Anatomy of Ox*. Bio Green Books, New Delhi, pp. 9-15.

Taha, A.A.M., and Abdel-Magied. E.M. (1994). Some anatomical studies on the thyroid gland of calf and adult camel. *Veterinary Medical Journal*, Giza. **42**(1), 1001-1060.

Todini, L. (2007). Thyroid hormones in small ruminants: Effects of endogenous, environmental and nutritional factors. *The Animal Consortium*, **1(7)**:997-1008.

Umar, A.A., Atabo, S.M. and Sonfada, M.L. (2018). Rostral Dental Eruption Pattern in Red Sokoto Goat Ecotypes. *Vom Journal of Veterinary Science,* Vol. 13, 2018: 15 – 20.

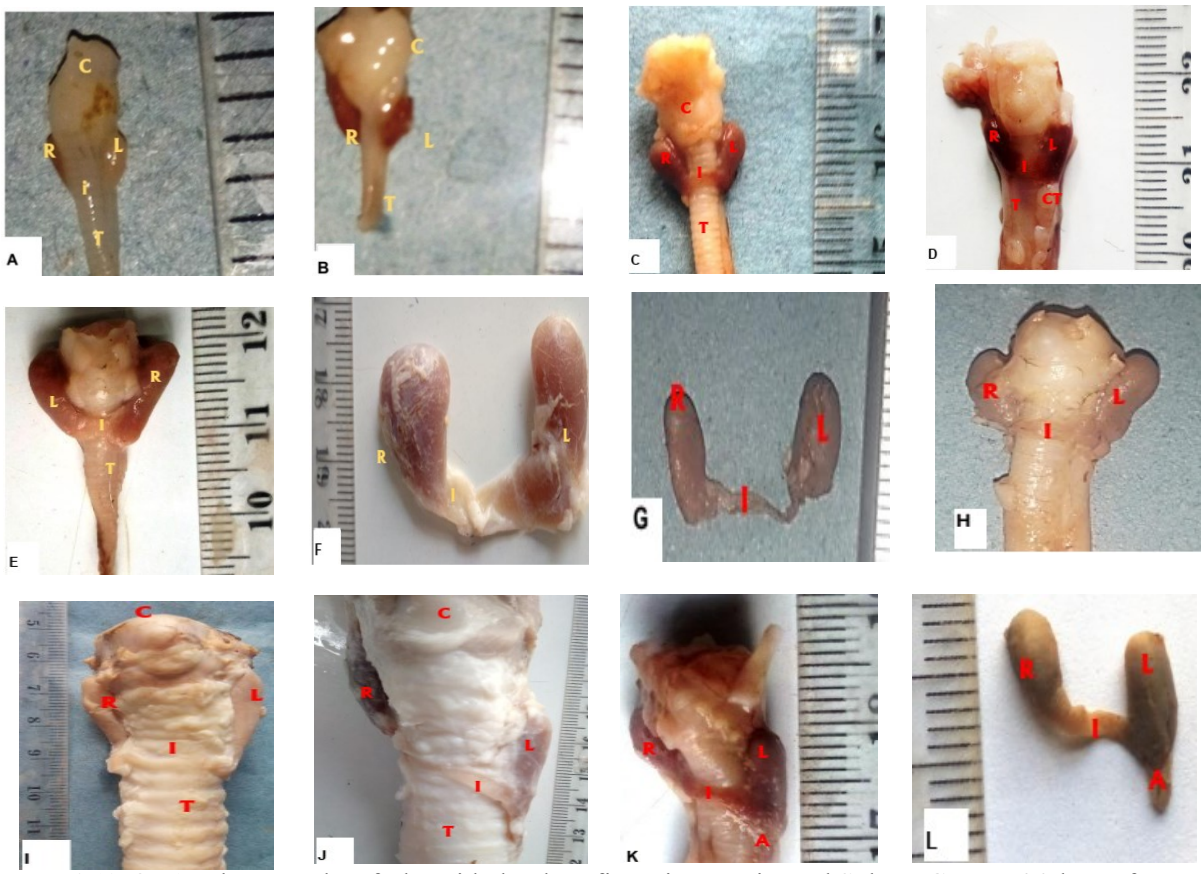


Plate 1 (A & B): Photographs of Thyroid glands at first trimester in Red Sokoto Goat at 46 days of gestation (**A**) and Sahel Goat at 49 days of gestation (**B**), showing C= Cricoid cartilage, R= Right lobe, L=Left lobe, T= Trachea, I= Isthmus. **Plate 2 (C & D):** Photographs of Thyroid glands at Second trimester in Red Sokoto Goat at 82 days of gestation (**C**) and Sahel Goat at 94 days of gestation (**D**), showing C= Cricoid cartilage, R= Right lobe, L=Left lobe, T= Trachea, I= Isthmus**,** CT= Cervical part of Thymus. **Plate 3 (E & F):** Photographs of Thyroid lobes at Third Trimester in Red Sokoto goat at 108 days of gestation (**E**) and Sahel goat at 112 days of gestation (**F**), showing R= Right lobe, L=Left lobe and I= Isthmus**,** T= trachea. **Plate 4 (G & H):** Photographs of Thyroid lobes of Prepubertal age in Red Sokoto Goat (**G**) and Sahel goat (**H**), showing R= Right lobe, L=Left lobe, I=Isthmus. **Plate 5 (I & J):** Photographs of Thyroid glands at Pubertal age in Red Sokoto goat (**I**) and Sahel goat (**J**), showing T= Cricoid cartilage, R= Right lobe, L=Left lobe, T= Trachea, I= Isthmus. **Plate 6 (K & L):** Photographs of Thyroid glands of Adult age in Red Sokoto Goat (**K**) and Sahel goat (**L**) showing T= Cricoid cartilage, R= Right lobe, L=Left lobe, T= Trachea, I= Isthmus, A= Accessory structure of thyroid gland.

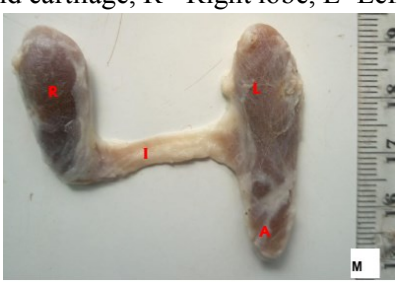


Plate 7: A Photograph of Thyroid glands of Sahel goat at adult age, showing R=Right lobe, L=Left lobe, I=Isthmus and A=Accessory structure of thyroid gland.