



# ONTOGENESIS OF THYROID GLAND IN AWASI SHEEP FOETUSES: PRENATAL STUDY

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## Abstract

The present work was designed to investigate the characteristic features of anatomical and histological development of the thyroid gland in prenatal stages with of local domestic Iraqi awassi sheep (*Ovis aris*). The study was carried out in the college of veterinary medicine / Al-qasim green University to study of histomorphological changes of thyroid gland at different stages of intrauterine. The study was performed on health female's pregnant sheep where collected 12 sheep's fetuses distributed into three stages: 45-50 gestational age, 65-70 gestational age and 106-110 gestational age (four fetuses for each age). At 45-50 day of gestational age, thyroid gland consist of two lobes connected by structure called isthmus and located in the throat on both sides of larynx and trachea and it was firm in texture and rose in color. Histologically, it is composed of a solid mass of mesenchymal cells arrangement randomly in the neck region and clear capsule that covered the gland and very small number of primitive follicles stored limited amount of colloid and very small number of parafollicular cells while; at 65-70 day of gestational age, the thyroid gland consist from two lobes connected by isthmus and located in the neck region on both sides of larynx and trachea and it was firm in texture and rose in color. Histologically, the thyroid gland at this stage composed of a solid mass of epithelial cells covered by thick capsule, the primitive follicles found in small number which stored very limited amount of colloid and the parafollicular cells appear in this stage. At 106-110 day of gestation age, the thyroid gland consists from tow lobes connected by thin isthmus and located in the neck region on both sides of larynx and trachea. Histologically, the thyroid gland covered by connective tissue capsule and there were trabeculae which divided the gland to lobules and the center of gland showed number of small, non-developing follicles that raise gradually from rearranged of the solid epithelial cords and very few colloid found in this stage. The parafollicular C - cells were seen during this stage.

**Key words:** Development, Fetuses, Thyroid gland, Ontogenesis, Prenatal.

## Introduction

The sheep in Iraq distributed in five breeds (Hamdani, Karadi, Arabi, Naeimi and Awasi). The sheep in Iraq a very important economic ruminants for meat, milk and wool production. Awasi sheep (*Ovis aris*) the more species spreading in middle of Iraq that brought in belongs to the family Bovidae, subfamily Caprine, Genus ovis. Thyroid gland is one of the most important endocrine gland in body which secretes thyroglobulin hormones, thyroxin (T4), triiodothyronine (T3) and Calcitonin hormones (Machado- Santos *et al.*, 2013) That is plays a central role in regulation of metabolic activities of the body and fetus development in mammals (Hill *et al.*, 2003). Also, thyroid gland and it's hormones play a crucial role in nervous, immune and reproductive system and

other systems in its development and functions (Krasses *et al.*, 2000).

Anatomically, the thyroid gland consisted of two lobes connected by an isthmus. The positions of the two lobes are different within the same animal. Thyroid lobes are situated in the cranial part of the trachea, extending from the 1<sup>st</sup> to 12<sup>th</sup> tracheal rings; the right lobe is located often cranially to the left lobe. The isthmus is a thin and narrow structure which is not clearly identifiable in most species (Dyce, 2009 and Hamad, 2008). The thyroid is the largest and the first recognizable endocrine gland in development of vertebrates. Marked variation in location, gross and histological features of thyroid gland in different vertebrates have been observed by (Dyce *et al.*, 2009). The thyroid gland is the first glandular structure to form, that's develops from endodermal diverticulum-the

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thyroglossal duct that forms in the floor of primitive pharynx.

Histologically, Jarrar and Faye (2013) have shown that the thyroid gland was covered by a fibrous connective tissue capsule, which gave inward septae to divide each lobe into various lobules and each lobe consist from many of follicles which are lined by follicular cells (Kausar and Shahid 2006) and between the follicles there are parafollicular cells have locations throughout the thyroid gland parenchyma (Hussin and Altaay, 2009).

Because there are no details sufficient study about ontogeny of the thyroid gland in the Awasi sheep (*Ovis aris*) in prenatal life so the study designed to provide a more complete quantitative description of the histomorphological developmental of the thyroid gland (prenatally).

### Material and Methods

The study was performed on twelve sheep fetuses that collected from healthy pregnant ewes slaughtered in the abattoirs of Baghdad, Najaf and Babylon provinces for prenatal study. The sheep fetuses at prenatal stages distributed into three groups: (first, second and third trimester) according to the gestational age which determined depending on the crown rump length (CRL) by using of following formula ( $Y=2.74X+30.15$ ) (Gall *et al.*, 1994). The thyroid gland of sheep's fetus were fixed at 10% neutral buffered formalin, dehydrated in a graded series of alcohol, cleared in xylene then embedded in paraffin wax. The blocks were sectioned at 5-6  $\mu$ m thickness of slice using a rotary microtome. histological sections were stained with haematoxylin and eosin, PAS and Masson trichrome (Suvarna *et al.*, 2018). The sections were studied using Olympus light microscope with digital camera USB which connected with the computer slides and attachment at different magnification.

### Results and Discussion

**At the foetal age of (6.640  $\pm$  0.132) cm CRL (45-50) days and the weight of fetus about (142 $\pm$ 2.213) gram**, anatomically; in this age, the results showed that the thyroid gland consist from two lobes connected by structure called isthmus, the gland was located in the throat on both sides of larynx and trachea, the right lobe was triangle in shape and extend from distal end of cricoid cartilage of larynx to the ventral surface of 6<sup>th</sup> tracheal rings, and the left lobe was oval in shape and extend from 1<sup>st</sup> to 7<sup>th</sup> tracheal rings, where the right lobe laid proximal to the left lobe. The lobes lay on either sides of the trachea and esophagus, and the isthmus was crossed the trachea anteriorly in curved line over the 6<sup>th</sup>

and 7<sup>th</sup> tracheal rings. Also, the thyroid was firm in texture and rose in color (Fig. 1). Similar findings were recorded about the locations of isthmus in early post natal goat between 0 to 90 days of age by Baishya *et al.*, (1985). This result not corresponding with Hajóvská (2002) found smooth asymmetry of the left lobes in the cranial direction in all fetuses from 32<sup>nd</sup> to 36<sup>th</sup> day of embryonic development of the thyroid gland in small ruminants.

Histologically; the thyroid gland at early stage of embryonic life composed of a solid mass of mesenchymal cells (endodermal cells) which appear as conglomerated cells or arrangement randomly in the neck region and clear capsule that covered the gland. The aggregation of epithelial cells may be identified as solid cords of epithelial cells. Follicles are not organized, but very small number of primitive follicles stored limited amount of colloid were detected at this stage of thyrogenesis. The cells which found in the gland give follicular epithelial in the future and between it there were large-light cells with large round nucleus that were the inter follicular cell (C-cell) (Fig. 2). These results are same as the results of that recorded previously in bovine by (Abdel-Magied, *et al.*, 2000 and Al-gebory, 2017) who stated that the thyroid at early stage of embryonic life composed of a solid mass of mesenchymal cells covered by capsule. Also, (Ramji Prasad and Yashwant Singh, 1989) observed that in the goat fetus at 45-50 days of gestation the parenchyma of the thyroid gland consisted of solid epithelial cords separated by mesenchymal tissue.

**At the foetal age of (14.00 $\pm$ 0.316) cm CRL, (65-70) days and the weight of fetus about (297 $\pm$ 2.549) gram**, anatomically; the results showed that, in this age, the thyroid gland consist from two lobes laid on each sides of larynx and trachea at ventro-laterally surfaces . The right lobe was triangle in shape and extend from the thyroid laryngeal cartilages to the ventral surface of 4<sup>th</sup> tracheal rings and the left lobe was oval in shape and extend from the end of cricoid cartilage of larynx to the 5<sup>th</sup> tracheal ring. The right lobe laid proximal to the left lobe and connecting anteriorly by clear structure called isthmus over the 5<sup>th</sup> tracheal ring (Fig. 3). This result is corresponding with (Miyandad, 1973) in large animals like cattle and buffaloes and in camels by (Bello *et al.*, 2014). Also, in cattle the isthmus is a broad parenchymal tissue, while in small ruminants it is inconstant, and when present is merely connective tissue (Dyce *et al.*, 2009; Hajóvská, 2002). In the rats and the mouses, an isthmus is present and located at the caudal end of the lobes (Ingbar, 1985).

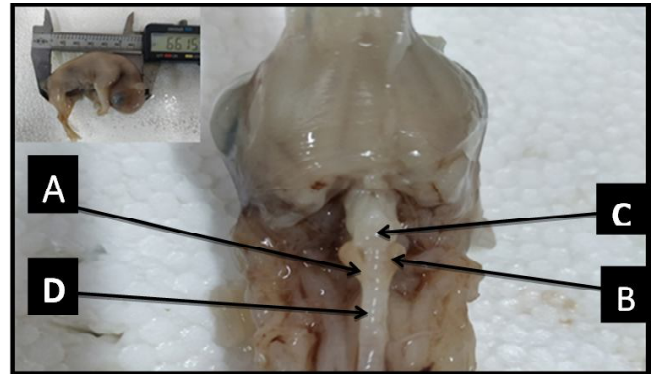
Histologically; The thyroid at this stage of embryonic life composed of a solid mass of mesenchymal cells in

the neck region, and was covered by connective tissue capsule but very limited aggregation of epithelial cells may be identified as solid cords of epithelial cells. The epithelial cells began to arrangement to forming the follicles but not distinguish the follicles, only small number of primitive follicles that stored small amount of colloid were detect in this stage. There were number of larger-light cells with large, round nucleus these were the inter follicular cell (C-cell) and the Sinusoids were present between the follicles (Fig. 4). These results are agree with results of (Aughey and Frye, 2001) observed that in animals, the thyroid gland was surrounded by capsule of dense irregular connective tissue; Roy and Yadava, (1977) in buffaloes, who founding that the capsule of the thyroid gland consisted layers of connective tissue separated by a layer of adipose tissue. Also, this study are corresponding with (Roy *et al.*, 1978) who noticed that in goat, the follicular epithelium comprised of two types of cells, follicular cells and light cells. Borda *et al.*, (1999) report that a very few C-cells in thyroid mass found in this age, this is agree with the present study.

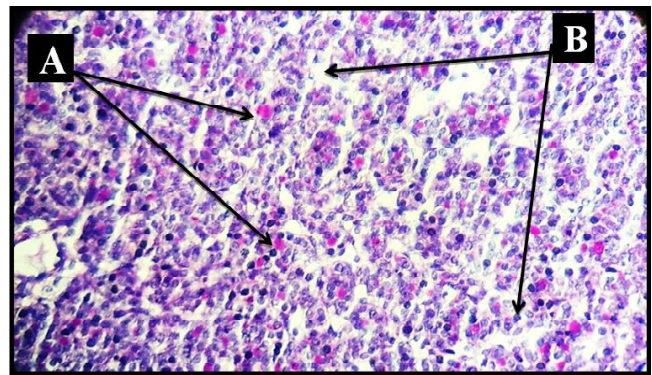
**At the foetal age of (29.800±1.322) cm CRL, (106-110) days and the weight of fetus about (600±7.071) gram**, anatomically, the results showed that the thyroid gland consist from two lobes was located on the throat for each sides of larynx and trachea. The right lobe was irregular in shape and extend from cricoid cartilage of larynx to the 6<sup>th</sup> tracheal ring, and the left lobe was elongated in shape and extend from the distal end of laryngeal cartilage to the 7<sup>th</sup> tracheal ring, where; the right lobe located cranially of left lobe, and the lobes connecting by very clear isthmus on the ventral surface of treachae between 6<sup>th</sup> to 7<sup>th</sup> tracheal ring in curved line. (Fig. 5). In the present study the position of the thyroid gland was generally similar to that of other adult mammals. The shape of thyroid gland differs with different animal. The shape of the thyroid lobes range from oval to elliptical or irregularly triangular (Venzke, 1975 and Bone, 1979). Pardehi (1981) found that the buffaloes thyroid glands consist of two lobes, their shapes were oval or irregular triangle. It may be that the differences amongst species in the mechanisms involved in migration of the thyroid and the morphogenetic events that take place in the neck and in the mouth contribute to determine the final position of the thyroid.

Histologically; the thyroid gland in this stage appears covered by connective tissue capsule and there were trabeculae which divided the gland to lobules and the center of gland showed number of small, no developing follicles that raise gradually from rearranged of the solid epithelial cords. These follicles were round to oval in shape

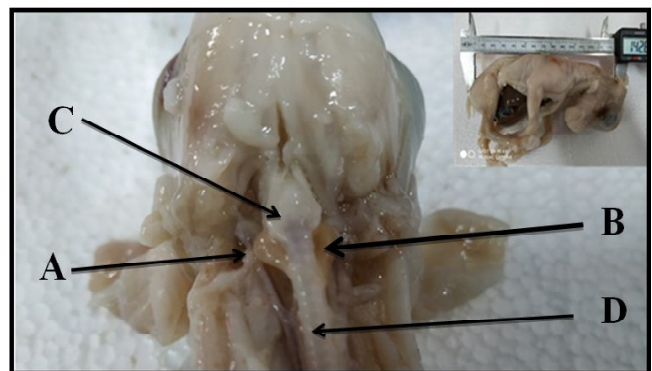
and lining by cuboidal cells with large nuclei and very few colloid found in this stage. These results are same as the results of (Bacha and Wood, 1990) in cow and pig reported that the thyroid gland was surrounded by capsule of connective tissue and divided into lobules by thin trabaculae. Mathur (1971) reported in the Asiatic water buffalo that, the follicles were spherical and small in fetuses. The epithelial cells of the fetuses were cuboidal



**Fig. 1:** Photographic section of sheep thyroid gland at 45<sup>th</sup> day of gestation age showing the following : A. Right lobe of thyroid gland ; B. Left lobe of thyroid gland ; C. Larynx ; D. Trachea.

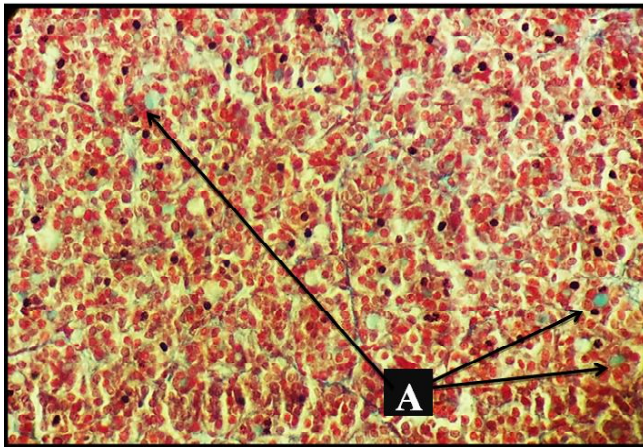


**Fig. 2:** Histological section of sheep thyroid gland at 45<sup>th</sup> day of gestation age showing the following : A. Colloid ; B. para follicular cells (C-cells) (magnification : 40XPAS).

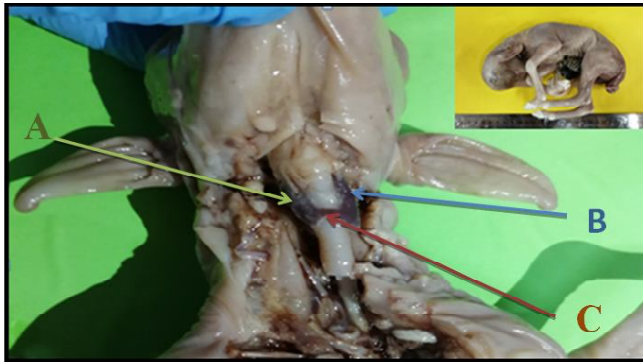


**Fig. 3:** Photographic section of sheep fetus at 68<sup>th</sup> day of gestation age showing the following : A. Right lobe of thyroid gland ; B. Left lobe of thyroid gland ; C. Larynx ; D. Trachea.

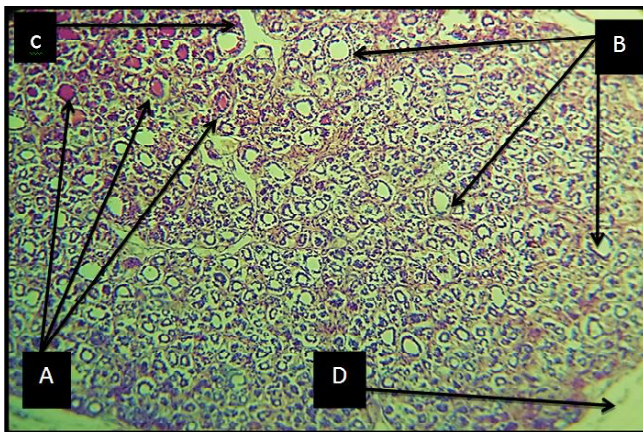
with round nuclei. Ghannam and Naggar (1973) opined that in the thyroid of buffaloes, acini were first observed in the fourth month of fetal life, but acinar differentiation began as early as the third month in the female and was



**Fig. 4:** Histological section of sheep thyroid gland at 68<sup>th</sup> day of gestation age showing the Homogenous colloid inside the primitive follicles. (magnification:40xMasson).



**Fig. 5:** Photographic section of sheep at 110<sup>th</sup> day of gestation age showing the following : A. Right lobe of thyroid gland ; B. Left lobe of thyroid gland ; C. Isthmus.



**Fig. 6:** Histological section of sheep thyroid gland at 110<sup>th</sup> day of gestation age showing the following : A. homogenous Colloid inside the follicles; B. Small Follicles; C. Trabeculae; D. thyroid capsule. (magnification:10xPAS).

late as the fifth month in the male. The presence of colloid was reported in prenatal cattle and buffaloes by (Ranjan *et al.*, 2011) while, A PAS-positive colloid was detected in human foetal thyroid at 13<sup>th</sup>–14<sup>th</sup> week of gestation (Gaikwad *et al.*, 2012) and It was also observed in the foetal thyroids of goats at 30 days of gestation (Igbokwe, 2013). The parafollicular C- cells were seen during this stage which can be easily distinguished midst the substance of the thyroid by their large size and pale staining properties. These results are similar to results of (Titlbach *et al.*, 1987) reported that in cat, the C cells of the thyroid appeared on the 38th day of gestation and approximately from the 50th day, got arranged in groups and began to occupy a characteristic position in relation to the follicular epithelium. The largest quantity of C cells was found in fetuses about to be born. Also, seen the myoepithelial cells which was elongated with spindle nuclei and the sinusoid was very clear through the glandular tissue (Fig. 6).

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