University of Thi-Qar Journal of agricultural research

Thi-Qar Journal of agricultural research

ISSN Onlin:2708 -9347, ISSN Print: 2708 -9339 Volume 15, Issue 1 (2026)

https://iasj.rdd.edu.iq/journals/journal/issue/20226 *https://doi.org/10.54174/utjagr.v13ii 54.*

Gross Morphology of the Thyroid Gland in Immature Male Dromedary Camels (Camelus dromedarius) in Al-Muthanna province

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I. Abstract

The present study was carried on morphological and morphometric characteristics of the thyroid gland in camel. The thyroid gland was consisted of two entirely separated lobes with isthmus and appeared as smooth elongated oval shape with rounded cranial, narrow caudal end it located on either side of the trachea. The gland is connected by an isthmus on the ventral side. The isthmus extends along the ventral side of the trachea, close to the level of the second and third segments. The size of the gland depends on the animal's age and physiological state, the gland is reddish-brown in color. The right lobe of the gland lies on the dorsomedial side of the trachea, extending from the first to the eighth segment. Similarly, the left lobe lies on the medial side of the trachea, extending from the sixth to the seventh segment. The trachea is connected to the lobes via the medial part. Furthermore, the lobes have convex lateral surfaces, and their dorsal and ventral borders are also convex.

II. Introduction

The Arabian camel is an animal capable of withstanding harsh environmental conditions without water or food for extended periods, a feat that would be detrimental to other animals **(Ouajd and Kamel, 2009).** This resilience stems from the close link between its anatomical characteristics and environmental adaptations. Known for its adaptation to harsh, hot deserts **(Ouajd and Kamel, 2009).** The camel possesses unique survival characteristics not found in other animals. As a ruminant, the camel is adapted to living in a hot, dry climate. The internal state of the animal's body depends on its endocrine system; therefore, the thyroid gland plays a significant role in influencing other organs. **(Abdussamad *et al.*, 2011; Marisa, 2011; Ahmadpanahi and Yousefi, 2012).** The Arabian camel holds significant economic value as a grazing animal due to its remarkable adaptability to harsh environmental conditions and its resistance to various diseases. This adaptability is a defining characteristic and the primary reason for its reputation as a unique and exceptional animal among large mammals. The camel's ability to adapt stems from variations in its endocrine system, which comprises several glands, including the thyroid, adrenal, pituitary, and parathyroid glands. These glands participate in a multitude of functions, including development, growth, metabolism, and temperature regulation. However, there is a lack of research focusing on the morphological

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differences within these glands **(Rejeb *et al.*, 2011; Bello *et al.*,2014; Aden, 2015).** The thyroid gland, one of the largest and most important glands in all mammals, receives 2% of the heart's energy output and produces the hormones thyroxine and triiodothyronine **(Abdullah *et al.*, 2010.; Igwenagu et al., 2016).** It also plays a role in overall metabolism, energy regulation, growth, and the functions of specific organs, among other functions, including temperature regulation. Despite this, many morphological differences remain unstudied. Completely, which helps in the resistance and adaptation of camels to desert conditions **(Kausar and Shahid, 2006; Ouajd and Kamel,2009)**

III. Materials and Methods:

Animals of study

The current study was carried out on ten healthy (1-3years) local male camel age. After recording the body weight was (325,000 ± 75,000 g) these animals were used for morphological and morphometric of thyroid gland assay.

Study design

(10 immuture) one humped camel used for morphological and morphometric studies. After extirpation of thyroid glands, it washed by normal saline solution. Small piece of tissue (1 cm) from the two thyroid lobes right and left lobs was fixed with (10%) formalin solution for (48) hr. washed with running water overnight then dehydrated in a seconding grades alcohol, cleared in xylene then embedded in paraffin way section of (6-7) were stained with hematoxylin and eosin stain for the describe the histological structure, Masson's Trichrome stain for collagen fibers, and PAS stain for glycoprotein and mucopolysaccharides.

The morphological description of the thyroid gland

before fixation included observations related to the overall study, which included the gland's shape, color, location, surface, and its relationship to other organs by useing using a Sony Cyber-shot 14.2 mega pixel digital camera.

Anatomical measurements of the gland included:

1. Weight (grams): The weight of the gland was measured using a sensitive digital scale
2. Length (cm): The length of each thyroid lobe was measured using an electronic digital scale (Vernier).
3. Width (cm): The width of the thyroid lobes was measured using an electronic digital scale (Vernier).
4. Thickness: A digital Vernier calculator was used to measure the thickness of each thyroid lobe **(Salih,2018).**

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IV. Results and discussion :

The thyroid gland in camels is reddish-brown in color and is a large, bi lobed organ located in the posterior region of the larynx, it consists of two elongated oval lobes on either side of the trachea, extending across the isthmus from the ventral surface. The isthmus is clearly visible on the ventral surface of the trachea at the second and third segments (Fig. 1), this result it agrees with **(Kausar and Shahid, 2006; Ahmadpanahi and Aden, 2015)in camel** These lobes are joined superficially by an isthmus along the ventral surface of the trachea at the position of the second and third rings. This aligns with the morphological characteristics of camels and gazelles **(Salih, 2018)**, which are similar to other mammals. However, it differs from goats **(Adhikary, et al., 2003).** and buffalo **(Altaay, 2007)** which have two oval lobes, one semicircular anteriorly and the other pointed at the end. It also differs from pigs **(Swindle, et al.,2012).** where each lobe is conical. Furthermore, it differs from the thyroid gland in dogs and cats **(Barberet, 2010).** which is found to consist of two bean-shaped lobes. This may be due to physiological factors, as the body needs to produce hormones for various functions, including metabolism to generate heat. This is crucial for maintaining a stable and high body temperature and also plays a role in growth and reproduction.

The lateral surfaces of the thyroid lobes appear convex, while the medial surface is concave. The ventral and dorsal borders of the lobes are convex and were associated with the tracheal rings. They have two borders; the dorsal border is thinner than the ventral one and is covered by the sternothyroid muscle. The right lobe is closer to the head than the left lobe. This agrees with the findings in the gazelle **(Salih, 2018)** and differs from those in the dog **(Rajathi, et al.,2019).** who reported that the lateral surfaces of the sternohyoid and sternocephalic muscles appear concave. These resultsThis indicates that the degree of convexity and concavity varies depending on the size of the trachea, the thickness of the cartilage rings, the shape of the lobes, and the extent of glandgrowth.Thyroid Lobes: The right lobe is located on the dorsolateral side of the trachea andextends from the first to the eighth ring. The left lobe extends from the second to the sixth or seventh ring on the medial side of the trachea. The medial surface of the lobes is attached to the trachea. The right lobe is larger than the left lobe, and this result agrees with the results in camels. In Pakistani camels, it agrees with the results in camels with **(Ahmadpanahi andYousefi, 2012; Bello, et al., 2014).**It differs from the results of those who said that the horse's thyroid gland, which is located between the third and sixth segments of the trachea, consists of two lobes located in the posterior part of the larynx. It also differs from the results of those who said that it is located in the first segments, from the first to the twelfth segment of the trachea **(Kausar andShahid 2006)** and disagrees with **(Budras, et al., 2008 ;Davies, et al., 2010)**. In the anterior region of the trachea, it was found .that the lobes of the goat's thyroid gland extend between the fourth and eighth segments **(Bhardwaj,et al., 2006; Shehan, 2017)**.

These results may be attributed to the fact that the activity of the right lobe is greater than the left lobe. This result contradicts what was mentioned **(Ali, et al., 2015)** in sheep, where the left lobe was significantly larger compared to the aver age size of the right lobe of the thyroid gland. The right lobe was well-developed in cows, while the left lobe and isthmus were narrow, according to what was mentioned **(Casmir, et al.,2015) .**Likewise, the lobes of the gland are asymmetrical in dogs and sheep **(Barberet, 2010;Ali, et al., 2015)**. Sheep have two lobes, with the additional lobe being either absent or present as an extension of one of the lobes.The shape and size of the lobes vary among different species; they may be oval, oblong, or irregular.The two lobes of the gland are connected by an isthmus**(Dyce, etal., 2010)**. The isthmus is a thin, transverse, and narrow band that connects the two lobes at their caudal ends and crosses the ventral side of the trachea at the level of the second and third segments**(Abdel**

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Magied, et al., 2000).This is consistent with what was mentioned in camels**(Abdel Magied, et al., 2000)** and differs with what was mentioned in goats and sheep**(Bhardwaj, et al., 2006),** where the isthmus extends between the fourth and eighth segments. This difference is due to the length of the neck and the number of tracheal segments.This is consistent with what was mentioned in buffalo**(Altaay, 2007)** and differs with what was mentioned **(Poonia, et al., 2023)**#, where it was stated that the isthmus is either absent or replaced by fibrous tissue. It also differs with the absence of the isthmus in cats**(Dyce, et al., 2010)** .The thin transverse isthmus that connects the lobes of the thyroid gland is similar to what was found in horses **(Budras, et al., 2008)** and differs with what was mentioned **(Ali, et al., 2015).**The results are attributed to the fact that the isthmus plays an important role in function and structure, as it ensures the equal distribution of hormones and also regulates blood and nerve flow to the thyroid gland, thus maintaining metabolic balance in camels.

This study shows a lack of asymmetry between the lobes of the thyroid gland in immature camels aged 1-3 years, the left lobe was longer and thicker, while the right lobe was heavier and wider (Fig. 2). This difference is normal and not a pathological condition and may be the difference in blood supply and functional activity between the two lobes. It is known that endocrine glands, including the thyroid gland, do not show complete asymmetry between the two lobes due to hormones or the distribution of blood flow. In addition, the animals that were studied fall within a young age group of one to three years, which means that the gland is in the stage of growth. It is known that the organ continues to develop in size and shape after birth, and this explains the difference in weights and dimensions. It is also interesting that the left lobe was longer and the left lobe was heavier .This indicates the possibility of an increase in tissue density or functional components histologically in the left lobe. This is also related to the difference in the size of the follicle. Increased accumulation of colloid matter, as the thyroid follicle is considered the basic structural unit of the gland, and its content and size are directly affected by the weight of the gland. Other studies conducted on other mammals have indicated similar variations in the lobes of the gland, which supports the results of this study. These differences are related to physiological factors and are not pathological.

Statistical Analysis

Morphometric measurements of the thyroid gland in immature camels showed significant differences between the right and left lobes. The average weight of the left lobe was 0.37±6.52 grams, while the average weight of the right lobe was 0.23±6.14 grams. This indicates that the left lobe weighs slightly more. However, statistical analysis showed that this difference was not statistically significant ($p< 0.05$) while the left lobe (3.72±64.68) mm is larger than the right lobe (3.19±61.) mm. However, the width of the left lobe (1.33±29.29) mm is wider than the right lobe (1.06±26.98) mm, and although this difference is apparent, statistical analysis confirmed it to be in significant. This is considered normal variation and not a true anatomical difference. As for thickness, measurements show slight variation, with the thickness of the right lobe (0.31±5.69) mm and the thickness of the left lobe (26±5.48)mm reaching, this difference is not statistically significant. Although there are slight numerical differences between the left and right lobes in all standard parameters (weight, length, width, and thickness), none of these differences reached the level of statistical significance. This indicates that all differences fall within the range of normal biological variation and do not represent true anatomical asymmetry.

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These results may be due to growth factors. The studied animals are in a pre-adult age group, and organs at this stage, such as the thyroid gland, may be undergoing growth and functional adaptation after birth. This leads to differences between lobes that are not statistically significant.

The thyroid gland in immature camels exhibits variation in size and weight, which is more likely related to functional and growth factors than to disease. These findings contribute to enriching and strengthening the basic anatomical data of the gland, and will be useful in future comparative and histological studies.

Table 1: Morphometrically measurements of thyroid gland (right and left) lobes from of Immature one humped camel

Type 0f animal	Morphometrical Measurements	Right lobe	Left lobe	T-test
		Mean ±SE	Mean ±SE	
Immuture camel	Weight(gm)	6.14 ±0.23	6.52 0.37	0.417 NS
	Length(mm)	61.81 ±3.19	64,68 ±3.72	5.02 NS
	Width(mm)	26.98 ±1.06	29.29 ±1.33	2.91 NS
	Thickness(mm)	5.48 ±0.26	5.69 ±0.31	0.337 NS
* (P≤0.05), NS: Non-Significant.				

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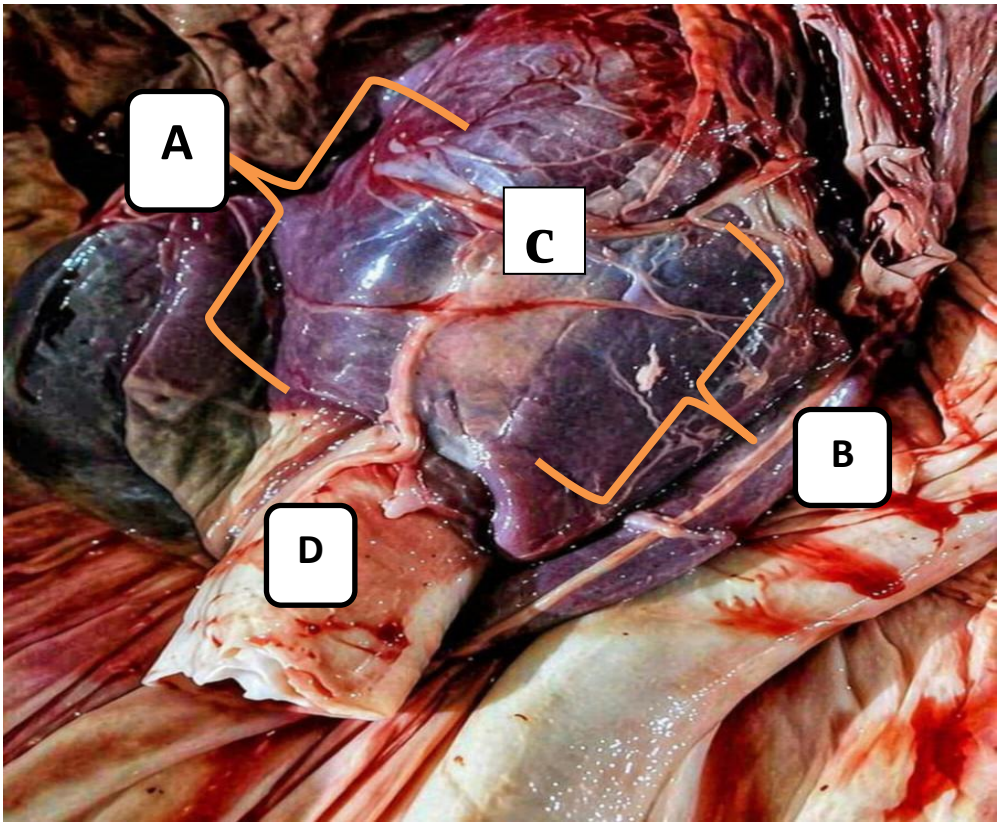

FIg. (1) . Gross sectionof thyroid gland in immature camel: A. right lobe, B. Left lobe , C. isthmus ,D. trachea

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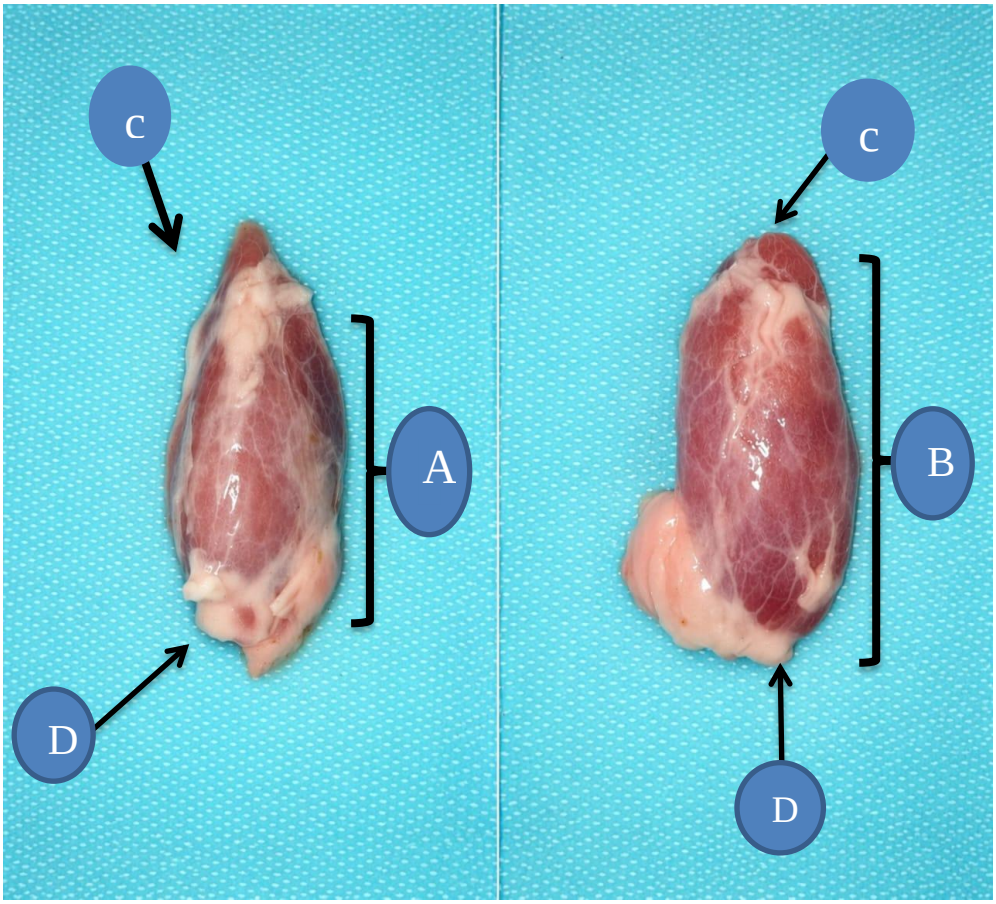

Fig.2. Gross section of , A. Left lobe ,B. Right lobe og thyroid gland in camel ,C .Cranial extremity , D. Caudal extremity

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