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RESEARCH ARTICLE

Evaluation of Prevalence of the Types of Thyroid Disorders Using Ultrasound and Pathology of One Humped Camel *(Camelus dromedarius)*

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Summary

The thyroid gland is the largest classic endocrine organ, that effects many organs of the body and plays a significant role in the process of metabolism in animals. The aim of this study was to investigate the prevalence of thyroid disorders diagnosed by ultrasound and microscopic lesions of the thyroid during the slaughter of apparently healthy One Humped Camels (*Camelus dromedarius*). Randomly, 400 male camels (with a mean age range of 4 to 8 years), were studied in 2012 to 2013. The Camels' thyroid glands were evaluated by ultrasound device using multi-frequency linear transducer 7-9 MHz caller doppler and in both longitudinal and transverse view. After stabilization of the sample in 10% buffered formalin and the process of preparation of paraffin sections in autotechnicon method, tissue sections of 5 microns in diameter were prepared and stained with H & E and finally examined by light microscopy. The results obtained in the pathology indicated the following: hyperplastic goiter (19%), degenerative changes (12%), follicular cysts (5%), follicular atrophy (4%), nodular hyperplasia (3%), adenoma (1%), carcinoma (1%) and simple goiter colloid (1%). Ultrasound evaluation of thyroid gland in adenoma and carcinoma showed enlargement of the gland, decreased echogenicity,and the heterogeneous thyroid parenchyma with irregular boundaries. Also, in follicular cysts were observed in the enlarged gland with no echo structures of different sizes and decreased echogenicity as a regional or general. In nodular hyperplasia, echogenicity and heterogeneous parenchymal were found to be increased. Comparison of the effects on the thyroid gland from different camels showed that there was no statistically significant difference (P>0.05). These findings suggest the use of Ultrasound as a screening test in the diagnosis of complications of thyroid disorders. Pathology also to be used for the diagnosis of thyroid problems and other side effects.

Keywords: *Thyroid gland, One Humped Camel, Ultrasound, Pathology*

Tek Hörgüçlü Develerde *(Camelus dromedarius)* Ultrasonografi ve Patolojik Muayene İle Tiroid Bozukluk Tiplerinin Preavalansının Değerlendirilmesi

Özet

Tiroid bezi vücuttaki pek çok organı etkileyen ve metablizma sürecinde önemli roller oynayan en büyük endokrin bezdir. Bu çalışmanın amacı kesim öncesi sağlıklı görünen Tek Hörgüçlü Develerde (*Camelus dromedarius*) ultrasonografi ve mikroskopik muayene ile tiroid bozukluk tiplerinin prevalansını araştırılmaktır. Çalışmada 2012 ile 2013 yılları arasında rastgele seçilen yaşları 4 ile 8 arasında değişen 400 adet erkek deve kullanıldı. Develerin tiroid bezleri longitudinal ve transversal doğrultularda olmak üzere multi-frekans lineer transducer 7-9 MHz doppler kullanılarak ultrason cihazı ile incelendi. Tiroid örnekleri %10'luk tamponlu formalin içerisinde tespit edildikten sonra parafin bloklar hazırlandı, 5 mikron kalınlığında kesildi ve H&E ile boyanarak ışık mikroskobunda inlendi. Patolojik incelemelerde hiperplastik guatr %19, dejeneratif değişiklikler %12, foliküler kistler %5, foliküler atrofi %4, nodüler hiperplazi %3, adenom %1, karsinom %1 ve basit guatr kolloid %1 olarak tespit edildi. Adenom ve karsinomlu tiroid bezlerinin ultrasonografik incelemeleri sonucunda bezin büyüdüğü, ekojinetisinin azaldığı ve düzensiz sınırlı heterojen tiroid parankimine sahip olduğu görüldü. Büyümüş bezlerde foliküler kistler de gözlendi. Nodüler hiperplazilerde, ekogenesiti ve heterojen parankimin arttığı gözlendi. Değişik develerdeki tiroid bezleri karşılaştırıldığında istatistiksel anlamda herhangi bir fark gözlenmedi (P>0.05). Bu bulgular ultrasonografinin tioid bozukluklarına ait komplikasyonları tarama amaçlı olarak kullanılabileceğini göstermektedir. Histopatolojik muayene ayrıca tiroid problemlerini ve diğer yan etkileri teşhis amaçlı kullanılabilir.

Anahtar sözcükler: *Tiroid bezi, Tek hörgüçlü deve, Ultrasonografi, Patoloji*

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INTRODUCTION

The thyroid gland is the largest classic endocrine organ which exude triiodothyronine, thyroglobulin and thyroxin hormones, that effects many organs of the body and plays a significant role in the process of metabolism in animals [1,2]. Thyroxin plays a significant role in metabolic activities of the animal body. The most outstanding characteristic of the vertebrate thyroid gland is its skill to concentrate large total of iodine for the synthesis of thyroxin and its disorders [2]. Thyroid hormones are involved in thermo-regulation of the body. In cooperation by other hormones, it raises the body temperature via oxidant of fat, CHO and protein and release heat [2-4].

Ultrasonography can be used as a screening test in the early evaluation of the patient, the results of other diagnostic procedures can be used to confirm its findings which could lead to more correct diagnosis [5].

The use of combined Ultrasonography and pathology of the thyroid can improve the diagnosis of patients with thyroid adenoma or carcinoma, parathyroid hyper-plasia and primary producer or neoplastic disorder. Ultra-sonography and pathology of the thyroid gland in animals such as sheep [6,7], goats and cows [8], cat [9], dogs [6] and horse [7] as well as in humans [10] have been studied.

Few studies have been done about histological and anatomical characteristics of camel thyroid glands in Iran [11], and no studies have been done about the use ultrasound and pathology for diagnosing thyroid disorders in One Humped Camel in Iran.

The present study was conducted to investigate the use of ultrasonography and pathology in the diagnosis of thyroid disorders of One Humped Camel *(Camelus dromedarius)* with the aim to evaluate the types of thyroid complications.

MATERIAL and METHODS

Sample Collection

This study was performed in the local abattoir of Najaf-Abbad, Esfahan province, central part of Iran from 2012 to 2013. In this abattoir, ruminants including sheep, goats, cattle and camels are slaughtered daily. The camels originated from east, south and south-east parts of Iran areas with warm, dry and windy weather. For this study, 400 thyroid glands of slaughtered one humped camel *(Camelus dromedarius)* (4 to 8 years old) were randomly inspected and specimens were taken for macroscopic and histo-pathological study.

Ultrasonography Investigation

The thyroid gland, in the view of the longitudinal and cross-section using an ultrasound device (EX8000 Medison ultrasound system) and multi linear transadiusr with frequency 7-9 MHz were studied.

Pathological Investigation

At the beginning of the thyroid tissue for longitudinal and transverse cross-section for different thyroid glands were examined macroscopically. The collected samples in 1 cm^3 thicknesses of the thyroid glands were fixed in 10% neutral buffered formalin (for period of 48 h) for histo-pathological examination. The samples were then de-hydrated in graded ethanol and embedded in paraffin wax. Sections of 5 µm in thickness were stained with hematoxylin and eosin (H&E) and then examined by an ordinary light microscopy.

Statistical Analysis

The data were entered, organized and grouped in the Microsoft Excel 2010. Data analysis was computed by using SPSS/PC-16.0 statistical software (SPSS Inc., Chicago, IL).

RESULTS

Ultrasonography Findings

Ultrasound of the normal thyroid parenchyma showed a uniform reflection and echogenic. In symptoms such as carcinoma and adenoma, enlargement of the gland often with reduced echogenicity and a heterogeneous range of irregular thyroid parenchyma were observed. Also thyroid enlargement in follicular cystic areas, without eco-structures with different sizes and decreased, reduced the echogenicity for regional or general, hyperplasia nudolar, increased echogenicity and being a heterogeneous parenchyma *(Fig. 1, 2, 3, 4,* and *5)*.

Pathological Findings

In thise study the major lesion of the thyroid gland was, the diffuse hyperplastic goiter with an abundance of 19%. Grossly, thyroid glands were enlarged uniform throughout the thyroid lobes. Follicles were irregular in size and shape and contained varying amounts of eosino-philic and vacuolated colloid. Some follicles were lack of colloid and collapsed. The follicles were covered by single or multiple layers of hyperplastic epithelial cells and formed papillary projections into the lumens *(Fig. 6)*. The frequency of nodular goiter was (3%). Affected thyroid showed multiple foci of hyperplastic follicular cells that were demarcated from the adjacent follicles. In microscopic study, hyperplastic nodules were composed of large, irregularly shaped follicles that lined by one or more layers of cuboidal cells. Papillary projections of follicular epithelium occurred into the lumen of some follicles *(Fig. 7)*. Other diagnosed lesion was colloid goiter

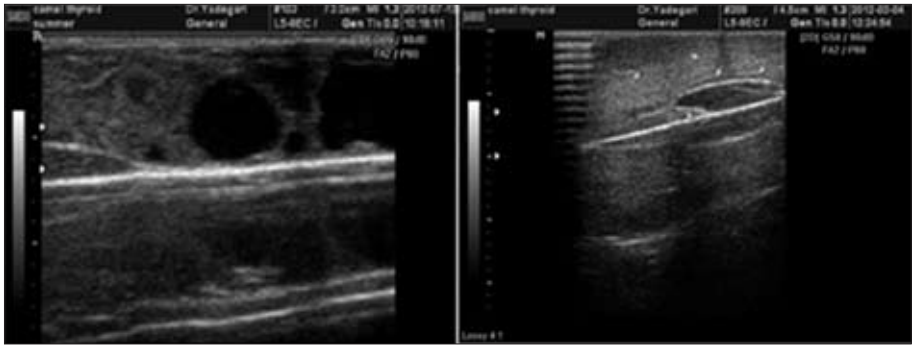


Fig 1. Decrease echogenicity for topical *(right)* and no reflection *(left)*, which is there with that expression cyst in multiple sizes

Şekil 1. Farklı boyutlarda kistle birlikte azalmış topikal ekojenite *(sağ)* ve yansıma yok *(sol)*

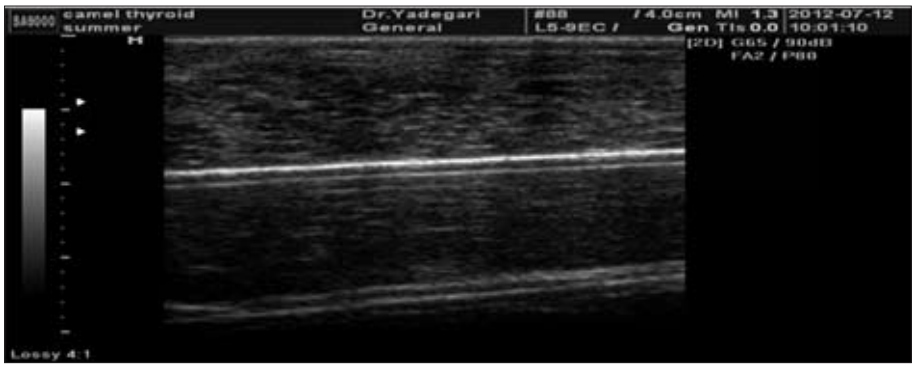


Fig 2. Diffuse increased echogenicity

Şekil 2. Diffuz artmış ekojenite

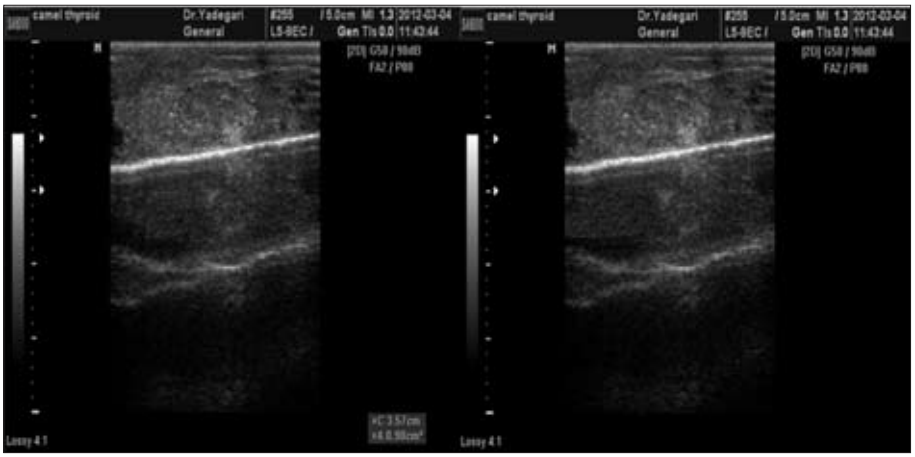


Fig 3. Nodules of the thyroid with hyperechoic and heterogeneous echogenicity

Şekil 3. Hiperekoik ve heterojen ekojeniteli tiroidte nodüller

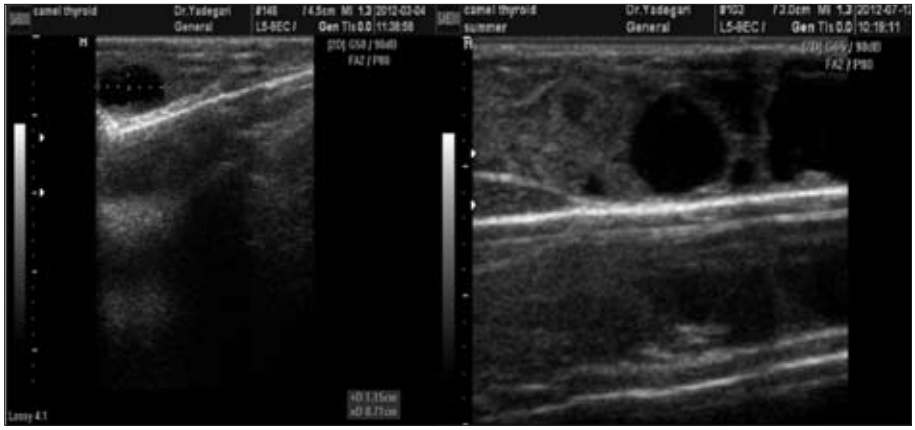
Fig 4. Local increased echogenicity

Şekil 4. Lokal artmış ekojenite

(1%). At the colloid goiter, follicles were dilated with deeply eosinophilic colloid. The macrofollicles were lined with flattened epithelial cells *(Fig. 8)*. Degenerative changes and atrophy was observed in (12%) and (4%) of thyroid samples respectively. The gland was smaller than normal. Follicles were shrinkage and contained little colloid. The epithelial cells of some follicles showed degenerative changes including eosinophilic cytoplasm and pyknotic nuclei. Follicular epithelium was desquamated into the space of follicles. Disruption of thyroid follicles was lead to

Fig 5. An echo areas and various sizes of cyst

Şekil 5. Bir eko alanı ve değişik boyda kistler



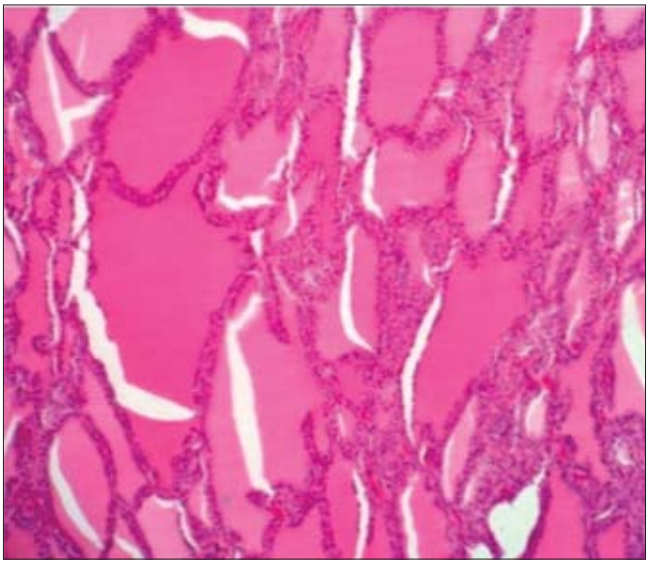


Fig 6. The follicles are irregular size and shape, and covered by single or multiple layers of hyperplastic epithelial cells. Papillary projections of hyperplastic epithelium are visible in the follicular space (H&E, ×100)

Şekil 6. Foliküller düzensiz boy ve şekillerde olup tek veya çok katlı hiperplastik epitelyum hücre ile örtülü. Foliküler boşluklarda hiperplastik epitelin papillar uzantıları görülmektedir (H&E, ×100)

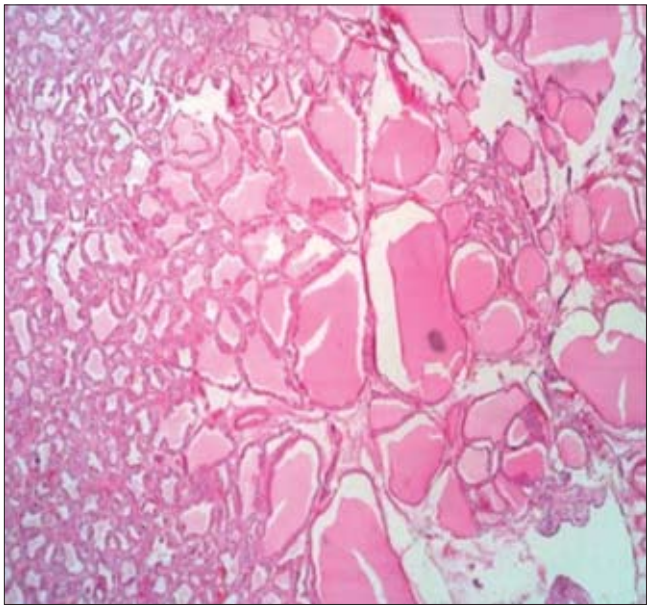


Fig 7. Nodular hyperplasia. Hyperplastic nodule *(right side of figure)* is composed of large and irregularly shaped follicles that lined by one or more layers of cuboidal cell (H&E, × 40)

Şekil 7. Nodüler hiperplazi. Hiperplastik nodül *(sağ tarafta)* bir veya çok katlı küboidal hücre ile çevrili büyük ve düzensiz şekilli foliküllerden oluşmuştur (H&E, × 40)

releasing of colloid into the interstitium and caused mild infiltration of lymphocytes. Also, fibrosis increased in the interstitial tissues *(Fig. 9)*. Follicular cysts were observed in (5%) of thyroid glands *(Fig. 10)*.

Follicular adenoma was observed in one case (1%). Grossly, thyroid was consisted of white-tan, small, solid nodules that were well demarcated from the surrounding thyroid parenchyma. The affected thyroid lobe was enlarged. Follicular adenoma was as solitary lesion in a normal gland and composed of microfollicular growth pattern *(Fig. 11)*. Papillary thyroid carcinoma was diagnosed in one sample (1%). Tumor cells had papillary pattern growth into cystic spaces of affected follicles. Papillary projection had fibrovascular stalks and lined with single or multiple layers of cuboidal cells. The nuclei were vesicular and pleomorphism and had prominent nucleoli *(Fig. 12)*.

DISCUSSION

The thyroid, the largest endocrine organ, influences the function of almost every organ in the body. The thyroid produces thyroxine (T4) and triiodothyronine (T3), which regulates the rate of metabolism and affect growth and rate of function of many other body systems [2,12]. Progressive basis of follicular epithelium loss and fat tissue inflammatory response [13]. Advanced follicular atrophy in dogs has been reported [13].

In the present study, thyroid pathological lesions observed included diffuse hyperplastic goiter, degenerative changes and follicular atrophy, diffuse lesions, follicular cysts, nodular hyperplasia, colloid simple goiter, adenocarcinoma, and adenoma follicular cells.

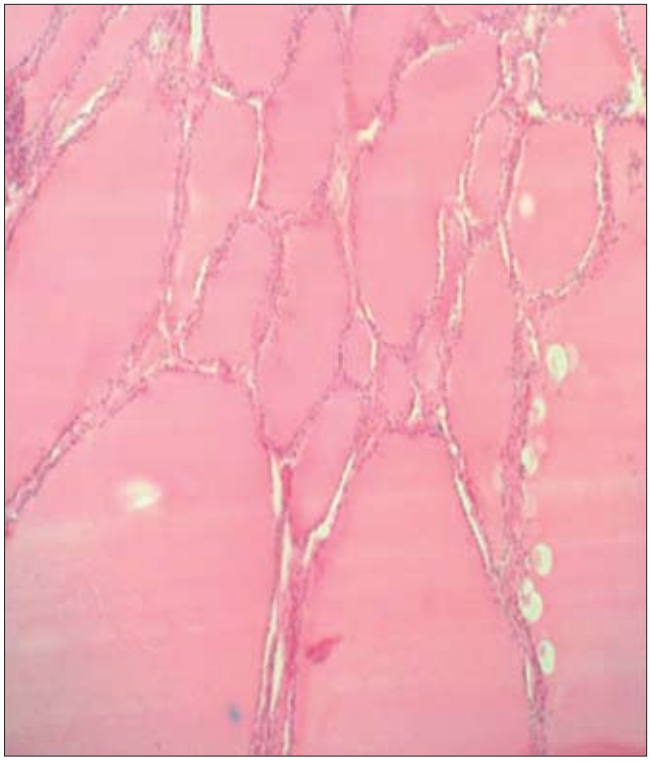


Fig 8. Goiter colloid. Follicles are dilated and filled with colloid (H&E, × 100)

Şekil 8. Kolloid guatr. Foliküller genişlemiş ve kolloid ile dolu (H&E, × 100)

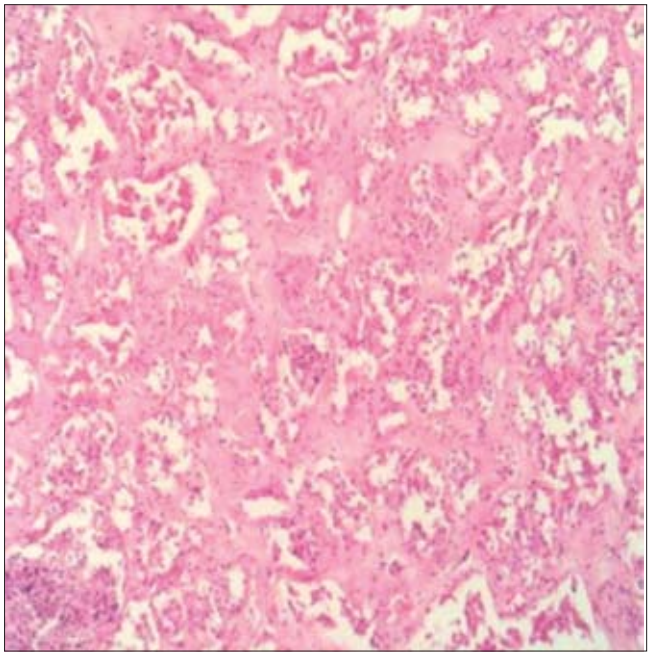


Fig 9. Follicular degeneration. Follicles are shrinkage and contained little colloid. Fibrosis increases in the interstitial tissues of follicles (H&E, × 40)

Şekil 9. Foliküler dejenerasyon. Foliküller büzüşmüş ve az miktarda kolloid içermektedir. Foliküllerin intersitisyel dokusunda artmış fibrozis (H&E, × 40)

Few studies have been done about thyroid glands of the camels. Though, Kausar and Shahid [12] reported, tissue

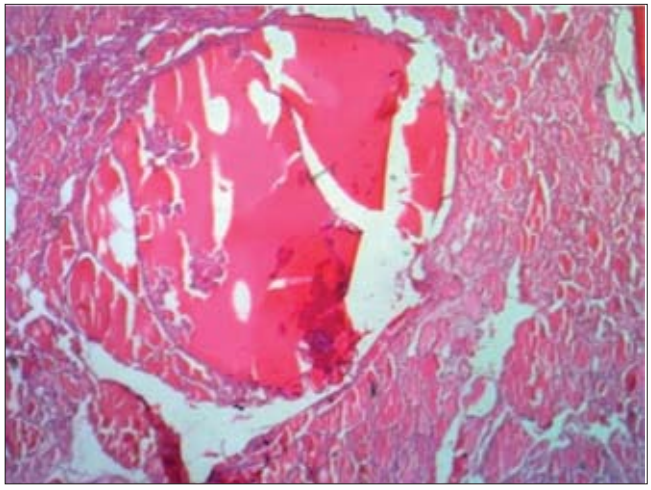


Fig 10. Follicular cysts (H&E, × 40)

Şekil 10. Foliküler kist (H&E, × 40)

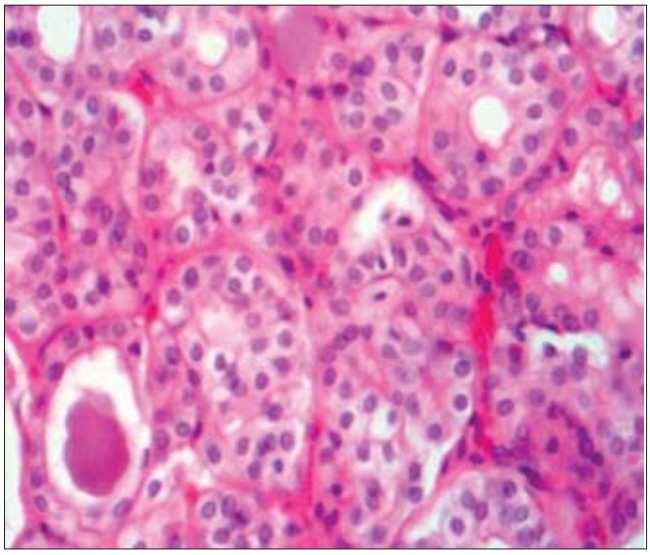


Fig 11. Follicular adenoma. It is compose of microfollicular growth pattern (H&E, × 400)

Şekil 11. Foliküler adenoma. Multifoliküler büyüme şekli (H&E, × 400)

samples of thyroid glands of 16 healthy camels *(Camelus dromedarius)* were investigated under two age groups i.e. group A (3-5 years) and group B (6-10 years) with equal number of animals, for their gross and microscopic anatomy.

In the present study nodular thyroid hyperplasia were observed. Nodular thyroid hyperplasia characterized by the formation of nonneoplastic nodules in the thyroid and has been reported in humans, horses, cats, dogs, and the rhesus monkey [14-17].

Follicular cyst was another prominent structure observed on the thyroid gland. Although the exact mechanism of this singularity is unknown, but the deficiency of vitamin A can be one of the possible causes that should be of interest to be used investigated [16].

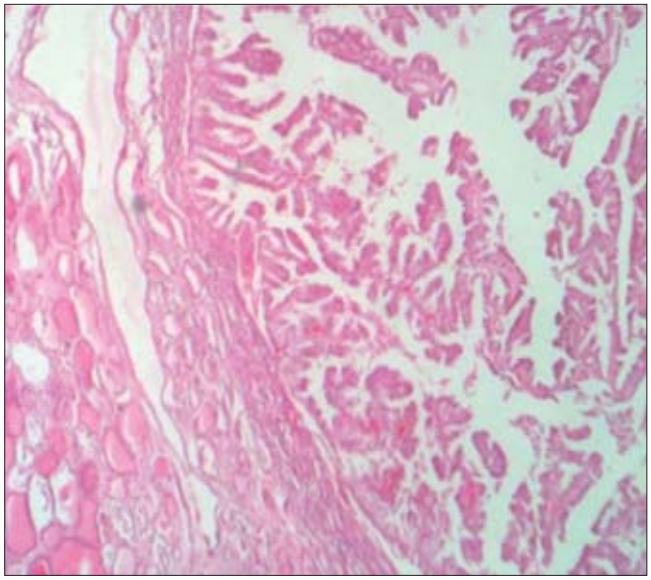


Fig 12. Papillary thyroid carcinoma. Tumor cells have papillary pattern growth into cystic spaces of affected follicles. Papillary projections have fibrovascular stalks and line with single or multiple layers of cuboidal cells (H&E, × 40)

Şekil 12. Papillar tiroid korsinomu. Tumör hücreleri etkilenmiş foliküllerin kistik boşlukları içine papillar uzantılar göstermektedir. Papillar uzantılar fibrovasküler bir sapa sahip olup tek veya çok katlı küboidal hücre ile çevrelenmiştir (H&E, × 40)

A Thyroid follicular adenoma findings in this study based on our understanding is the first report in camels in the world. A follicular adenoma is a benign encapsulated tumor of the thyroid gland. It is a firm or rubbery, homogeneous, round or oval tumor that is surrounded by a thin fibrous capsule. Adenoma of thyroid cystic adenoma (papillary, cystic) for the first time in cattle has been reported [13].

Mohajeri et al.[18], in their histopathological study on thyroid gland of goat in east Azerbaijan province of Iran examined a total of 386 thyroid specimens, where 71 cases had diffuse hyperplasia of thyroid follicular cells, 10 cases paranchymal cysts, 8 cases follicular atrophy, 5 cases colloid goiter, 4 cases thyroid fibrosis, 3 cases nodular hyperplasia and 1 case had C-cell adenoma and 1 case had C-cell carcinoma.

In a study by Alipourzamani et al.[19] in Tabriz of Iran thyroid glands of sheep were examined histopathologically. Of the total 100 thyroid examined, 33 showed various lesions on which 27% showed hyperplastic goiter, 4% showed colloid goiter and 2% showed lymphocytic (immuno-dediated) thyroiditis. Their findings were similar to our study by showing the highest frequency of the hyperplastic goiter.

Out of 800 pairs of thyroid glands in the study of Saber et al.[8], 15% had lesions in which histopathological changes were categorized as follicular atrophy (2.5%), focal hyperplastic goiter (0.88%), colloid goiter (3.39%), parenchymal cyst (1.38%), follicular cell hyperplasia (0.27%), thyroid fibrosis (0.635%), diffuse hyperplastic goiter and the parenchymal cyst (0.63%).

Other study by Nouri et al.[20] investigated 100 pairs of thyroid glands collected from ewes and their fetuses at the local municipal abattoir in Ahvaz city of Khuzestan province, multiple lesions were seen in 59% and 21% of the thyroid glands of ewes and fetuses, respectively. Histologically, ninety-nine lesions in the ewes and twenty-two lesions in the fetuses' thyroid glands were noticed. Histopathological changes for ewes were categorized as follicular hyperplasia (37%), bronchial cyst (31%), ultimobranchial cysts (14%), hyperemia and hemorrhagia (10%), follicular necrosis (4%), thyroiditis (1%), lymphocytic thyroiditis (1%), and trabecular adenoma (1%).

The pathologic conditions observed in thyroid glands of these animals (cow, sheep and goat) by Sayari et al.[7] included of simple colloid goiter: goat 12 (13.3%) cow 21 (11.66%) sheep 14 (15.5%), hyperplastic goiter: goat 43 (47.7%) sheep 30 (33.3%). parenchymal cysts: goat 3 (3.33%), cow 22 (12.2%), sheep 8 (8.9%), ultimobranchial nodules: goat 7 (7.7%) sheep 16 (17.8%) follicular atrophy: goat 10 (11.1%) cow 11 (6.66%) sheep 5 (5.5%), inflammatory and degenerative lesions: goat 4 (4.4%) cow 12 (6.6%) sheep 2 (2.2%). The number of animals without lesion included: goat 11 (12.2%) cow 114 (63%) and sheep 15 (16.6%).

There are several reports with pathological changes in the thyroid gland of various animals, including ruminants and dog [21,22]. The major pathological case of thyroid diseases is goiter [21-23], previous studies have shown that colloid goiter was most and thyroid lymphocytic inflammation was the lowest case of pathological lesions in buffalo of east Azerbaijan [24]. However, the hyperplastic goiter was the most and lymphocytic thyroiditis was the lowest thyroid pathology in carcasses of slaughtered sheep in East Azerbaijan [25]. The presence of lesion such as the types of goiter (colloidal and hyperplastic) in camels case study of deficiency iodine and deficiency vitamin A, calls for plans to prevent its occurrence. Perhaps the mode of feeding the camel is the main cause of this defficiency.

There seems to be some factors simultaneously that induce pathological changes in the thyroid glands of mothers and their fetuses. It is well known that among environmental factors two are more importantly to affect the thyroid glands: ambient temperature and feed intake [23,26,27].

The overall prevalence of thyroid problems can cause camel feeding and maintenance conditions of the animals.

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