Anatomical and Histological Study of Thyroid, Parathyroid and Ultimobranchial Glands in Iraqi Local Breed Turkey "*Meleagris gallopavo*"

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Summary

The present study is designated to demonstrate the distinctive features, location, shape and boundaries, as well as the histological structures and the blood supply of the thyroid, parathyroid and ultimobranchial glands in the local breed turkey *(Meleagris gallopavo)*. Twelve healthy birds from the local breed of Turkey were taken and divided into two equal groups: Six birds for anatomical study and six birds for histological study (three males and three females) for each study. Some anatomical parameters of the three glands which include: Length, width and volume, gross description, anatomical location and blood supply of the three glands were done. The anatomical results showed that the local breed Turkey has a pair of thyroid glands located in the thoracic inlet closely related to the common carotid artery and supplied with blood by three groups of arteries, the cranial thyroid, the middle thyroid and the caudal thyroid arteries. The mean length, width, weight and volume of the thyroid gland in turkey male were higher than in the female. Histologically thyroid gland enclosed by a thin collagenous capsule and consisted of spherical thyroid follicles lined by a single layer of epithelial cells enclosing a cavity filled with colloid and contain accessory parathyroid nodules between follicles. The Turkey bird also has asymmetrical pair of parathyroid glands, the right parathyroid gland located adjacent to the right thyroid gland while left one is being clearly separated from the left thyroid gland and located adjacent to or in contact with the left ultimobranchial gland medially to the common carotid artery, the gland in turkey is a single gland in all specimens. The mean length, width, weight and volume of the parathyroid gland in turkey female were more than in male. Histologically parathyroid gland is surrounded by collagenous capsule and composed of irregular anastomosing and branching cords of chief cells radiated about central sinusoids. The turkey bird also has a pair of ultimobranchial glands lying one on either side of the trachea, caudal to the parathyroid gland closely related to the bifurcation of the brachiocephalic artery. The mean length, width, weight and volume of ultimobranchial gland in turkey were of equal values between males and females. The gland composed histologically of different epithelial components including: C–cells or calcitonin–producing cells arranged as groups and loose cords, parathyroid nodules, vesicles or follicles of various shapes and sizes and cystic structure occupy most of the gland stroma. The mean length, width and volume of ultimobranchial founds in Turkey were similar in male and female.

Keywords: Turkey thyroid, Turkey parathyroid, Turkey Ultimobranchial.

Introduction

Turkey bird is large bird in the genus *Meleagris*, *species gallopavo* (commonly known as wild turkey). It is native to the forests of North America. The people of Mexico and the Southern United States enjoy the turkey birds and they are the first breeder in its productivity (1). It's one of the sources in the production of egg, meat and feather. These avian productions play a big role in the economics of animal worth in the world (2). Thyroid, Parathyroid and Ultimobranchial glands are endocrine glands, play a big role in the producing of endocrine hormones, which are essential for growth and body functions. Growth and differentiation/ maturation, and other several processes such as hatching, molt and reproduction are influence by these hormones (3). The purpose of the study leads to establish a definite diagnosis which is necessary to understand the anatomical and histological features in addition to the blood supply of the thyroid, parathyroid and ultimobranchial glands in the local turkey due to less research works about them in turkey birds.

Materials and Methods

This study including a total number of (12) adult healthy Turkey birds (6 males + 6 females) aged (11– 16) months, the weight between (3.250 – 4.500 Kgs) for the females and (4.500 – 7.800 Kgs) for males, the mean weight were (±4.912Kgs), birds were divided into two equal groups: Six birds for anatomical study and six birds for histological study: (3 males + 3 females) for each group. All the birds in the two groups were weighted and sacrificed by euthanasia by using high dose of xylazine by intravenous injection in the wing vein (25 mg/Kg. B.W), and left for (2-4 min.) to complete anesthesia, and the feathers were removed from the neck, sternum and chest, the skin incised by surgical scalpel, the neck, thoracic inlet and celomic cavity were opened, the ribs were cut from both sides and the ribs cage lifted to uncover the heart and its major arteries, then the thyroid, parathyroid and ultimobranchial glands were removed and weighted and some anatomical parameters of the three glands were done which include: Length and width (by using the vernia), weight by using sensitive balance (KERN and Sohn GmbH, D-72336 Balingen, Germany) and volume by (water displacement method) as well as the anatomical location included the description of each gland with its boundaries and blood supply of the three glands by using a mixture of ammonium hydroxide, latex and carmine stain in order to coloring the arterial blood supply by using syringes of (20ml) attached to a catheter and inserted in to a pinhole opened in the left ventricle of the heart. While in the histological study immediately after euthanized the birds, the three glands were removed from each bird and proceed with routine histological technique steps according to Luna (4).

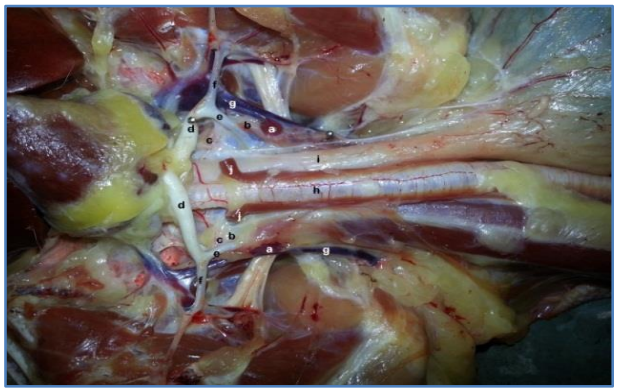
Results and Discussion

The anatomical results: The present work revealed that the Iraqi local breed turkey *(Meleagris gallopavo)* had the symmetrical pair of thyroid glands located in the thoracic inlet at the base neck on each side of trachea, closely related to the common carotid artery, in the area between the common carotid artery and jugular vein (Fig. 1) the present results are almost similar to the previous findings mentioned by (5 - 9) in domestic fowl, (10 and 11) in duck, (12) in pigeon and (13) in long-legged buzzard. The thyroid glands were determined on the lateral of the common carotid artery in the majority of the study material, each thyroid gland is oval or spherical in outline , red to dark red in color with glistening appearance (Fig. 1) resemble to that stated by (8 and 14 - 16) in chicken, (17) in duck, (13) in long- legged buzzard. The mean length, width, weight and volume of thyroid gland in turkey male were higher than in the female (Table, 1), It attributed these variances in values to the differences in the sex of turkey.

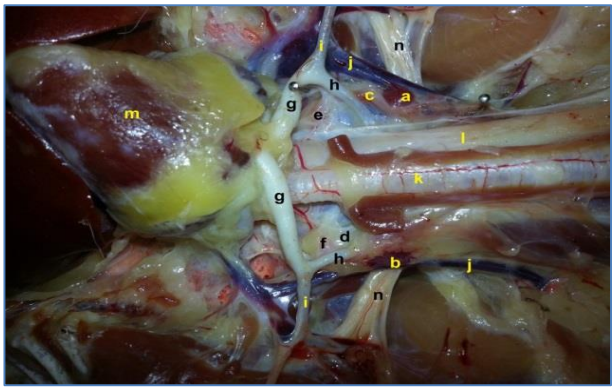
The second gland was the parathyroid gland. The current study elucidate that the turkey had asymmetrical pair of parathyroid glands, which was seen as a single gland on each side of body in all the study specimens (Fig. 2), although most species of birds possess between 2-4 glands on each side fuse together to form a single gland as mentioned by (7, 9, 17 and 18) in chicken, (19) in grey quail, (12) in pigeon, (20) in duck, so the present result is similar to the previous findings mentioned by (21) in chicken, (13) in long- legged buzzard and (22 and 23) in the Japanese quail. The right parathyroid gland located adjacent to the right thyroid gland between the common carotid artery and jugular vein, lateral to the common carotid and above the bifurcation of the brachiocephalic artery into (Fig. 2), so the present result is almost similar in the position as in chicken (24), in grey quail (19) and in duck (20). While on the left side the left parathyroid gland in turkey was being clearly separated from the left thyroid gland and located adjacent to or in contact with the left ultimobranchial gland medially to the common carotid artery at the level of its beginning from the point of the division of brachiocephalic artery into common carotid and subclavian arteries (Fig. 1) resembled to other birds reported by (9 and 21 - 25). Each parathyroid gland was rounded-oval or spherical in shape, whitish to yellowish in color, similar to its description mentioned by (21) in chicken (20) in duck and (12 and 26) in pigeon. The mean length, width, weight and volume of the parathyroid gland in turkey female were more

than in male (Table, 2), these variances in the dimensions between males and females may be due to the activity of parathyroid gland of females in the eggshell formation and calcification of tissues.

The third gland was the ultimobranchial gland, present results indicated that the turkey had a pair of ultimobranchial glands, lying one on either side of the trachea, each gland located in the thoracic inlet, caudal to the parathyroid gland closely related to the bifurcation of the brachiocephalic trunk (Fig. 2), this result is almost similar to the previous finding mentioned by (5, 14, 27 - 29). The left ultimobranchial gland located in close apposition to the posterior edge of the left parathyroid gland at the beginning of the common carotid artery from the point of the brachiocephalic trunk division (Fig. 2), resemble to that mentioned by (13, 14, 21 and 27) and thus it was relatively easily to recognized. While the right gland was more difficult to find because it lacked this attachment and it was find also closely related and beneath the point of division of the brachiocephalic artery but it separate from the caudal pole of the right parathyroid gland (Fig. 1), this result is in closely agreement with the previous finding of (5, 14, 27 and 29). Each ultimobranchial gland was small in size, pink in color (Fig. 2), similar to that of other domestic fowls as mentioned by (14, 17 and 28-30), their shape variously described between lenticular, ovoid or flattened and this agree with other domestic fowl mentioned by (14, 17, 27 and 29).



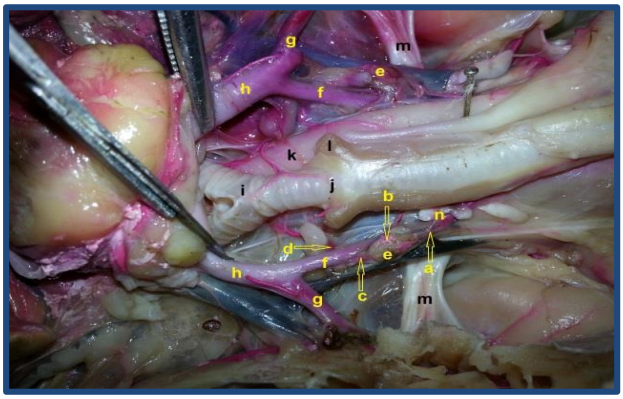
Figure, 1: Photograph in the thoracic inlet of turkey showed: a-Thyroid glands b-Parathyroid glands c- ultimobranchial glands d-Brachiocephalic artery e-Common carotid artery f-Subclavian artery g- Jugular vein h-Trachea i-Esophagus j-Sternotracheal muscle.



Figure, 2: Photograph showed: a- Right thyroid gland b- Left thyroid gland c- Right parathyroid gland d- Left parathyroid gland e- Right ultimobranchial gland f- Left ultimobranchial g. g- Brachiocephalic artery h- Common carotid artery i- Subclavian artery j- Jugular vein k-Trachea l- Esophagus m- Heart.

The mean length, width, weight and volume of ultimobranchial gland in turkey were of equal values between males and females (Table, 3).

The Blood Supply: The thyroid gland in turkey was supplied with blood by three groups of arteries, the cranial thyroid, the middle thyroid and the caudal thyroid arteries which almost derived from the common carotid and the esophagotracheobranchial arteries (Fig. 3), this result is similar to the previous finding mentioned in other domestic fowls by (15 and 31-33).



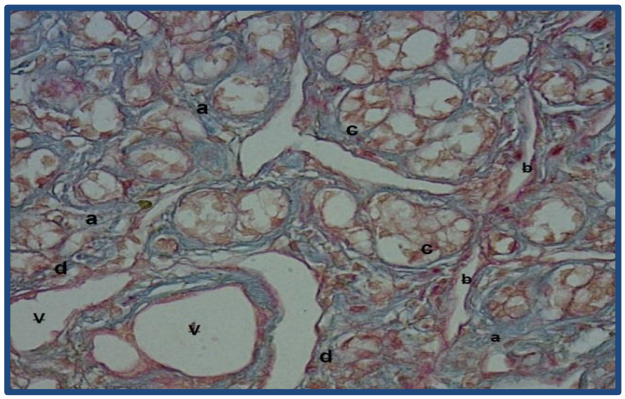
Figure, 3: Photograph showed: a- Cranial thyroid artery b- Middle thyroid artery c-Caudal thyroid artery d- Esophagotracheobranchial artery e-Thyroid gl. f- Common carotid artery g-Subclavian artery h- Brachiocephalic artery i-Syrinx j-Trachea k- Esophagus l-Sternotrachial muscle m- Brachial plexus n- Caudal lobe of thymus.

The parathyroid glands received their blood supply from two parathyroid arteries which branched out from the common carotid artery, one of these arteries is originated from the caudal thyroid artery (Fig. 3 and 4), similar results have been reported in other domestic fowls by (31 - 33) and the other is originated from the esophagotracheobranchial artery and

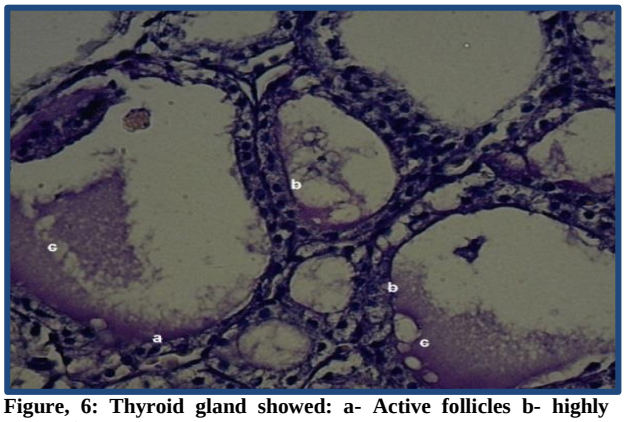
supplied the parathyroid gland as well as the ultimobranchial gland (Fig. 4), these results are resemble to that mentioned by (12 and 27).

Figure, 4: Photograph in the left side of thoracic inlet showed: a-Thyroid gland b-Parathyroid gland c-Ultimobranchial gland d-Cranial thyroid artery e-Middle thyroid artery f-Caudal thyroid artery g-Esophagotracheobranchial artery h-common carotid artery i-Subclavian artery j-Ascending esophageal artery k-Esophageal branch l-tracheal and syringical branch m-Brachial plexus.

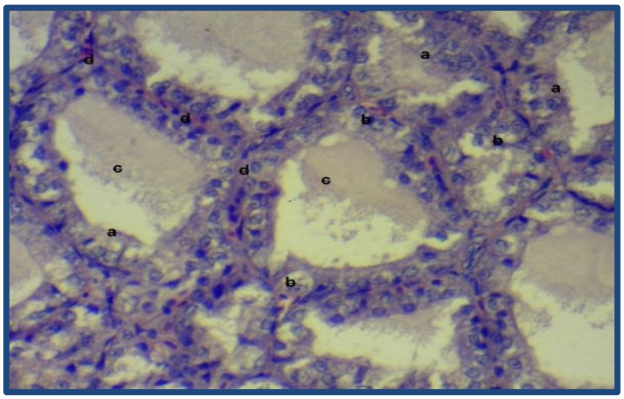
The current work indicated that the thyroid gland was enclosed by a thin capsule composed mainly of collagen fibers, the substance of the gland consisted of roughly spherical thyroid follicles with very little interstitial tissue and sinusoids, each follicle was lined by a single layer of simple cuboidal epithelium enclosing a cavity filled with colloid secretion (Fig. 5), and depending on the type of epithelium and shape of colloid the follicles classified as highly active, active and in active (Fig. 6 and 7), these results are resemble to that mentioned by (9 and 21) in domestic fowl, (11) in kuttanad duck. Results of the current study in turkey showed parathyroid tissue appear as nodules within the thyroid tissue and under the capsule of thyroid gland and this nodules didn't enclosed by capsule and contained anastomosing cords of parathyroid chief cells (Fig. 5), similar to previous findings of (14 and 31) who mentioned that parathyroid tissue is frequently found in the chicken and occupies different locations. The parathyroid glands histologically were enclosed by capsule of collagen fibers (Fig. 8), the parenchyma of the gland composed of irregular anastomosing and branching cords of chief cells separated by thin septa of connective tissue and these cords were radiated about numerous sinusoids (Fig. 9), these results are in agreement with the previous finding in the domestic fowls reported by (9), in pigeon (12) and in duck (20). The parenchyma of the gland was composed of single cell type: lightly stained chief cells, their shape were ranged from rounded to oval, elongated or polygonal with 1-2 nuclei (Fig. 10), similar to their shape in chicken (14, 21 and 24), in pigeon (12 and 26) and in duck (20).



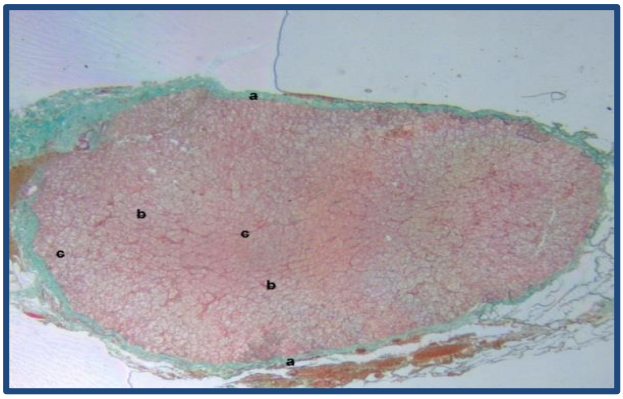
Figure, 5: Thyroid gland showed: a-Collagenous capsule b- Parathyroid nodule under the capsule c- Adipose tissue at the external part of the gland (Masson trichrome stain, 20 X).



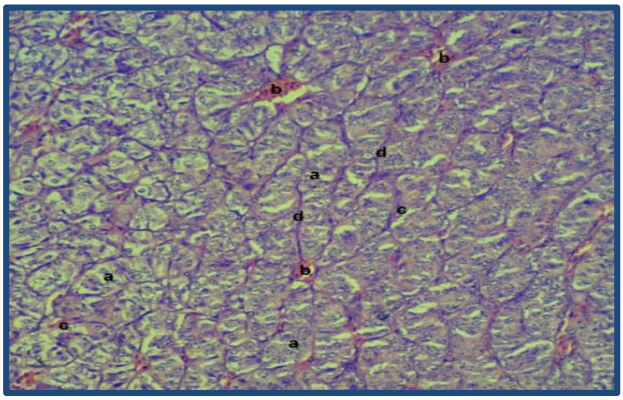
Figure, 6: Thyroid gland showed: a- Active follicles b- highly active follicles c- Follicular lumen contain vacuolated colloid d- Considerable variation in the follicular (PAS stain, 40X).



Figure, 7: Thyroid gland showed: a- Highly active thyroid follicles lined by cuboidal to columnar epithelium b- Nucleus: round-oval, centrally located with 1-2 nucleoli c- colloid d- Very little stroma between follicles (H and E stain, 40X).

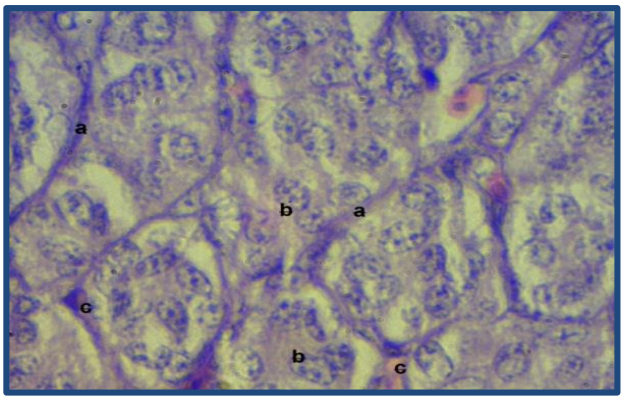


Figure, 8: Parathyroid gland shows: a- Capsule. b- cords of chief cells c- thin septa (Masson trichrome stain, 40 X).

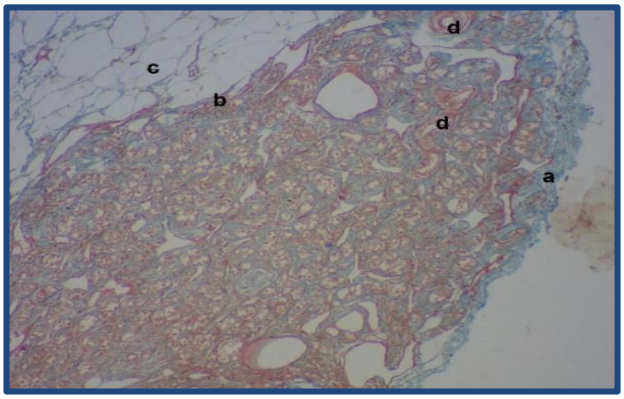


Figure, 9: Parathyroid parenchyma composed of: a- Cords of chief cells b- Sinusoids c- Thin septa d- Connective tissue sheath (PAS stain, 20 X).

In the other hand the histological observation of the current study in turkey revealed that the ultimobranchial gland enclosed by very thin capsule of collagen fibers (Fig. 11), this result is in agreement with that recorded by (27) in domestic fowl although other reports noted by (14 and 30) in domestic fowl, (29) in geese, founded that the ultimobranchial gland is not enclosed by capsule. The current study revealed that the capsule of ultimobranchial gland was observed only on the lateral side of the gland and obscured on the other side which embedded within the adipose tissue and apposite to the viscera (Fig. 11). This arrangement may be attributed to the protection of the gland by the collagenous capsule, also the present findings revealed that the gland was covered by a mass of adipose tissue which obscured the boundaries of the gland, so it could not be sharply delineated from the surrounding adipose tissue (Fig. 11). This result resembles that mentioned by (21 and 14) in domestic fowl, (30) in grass parakeet and (29) in geese. The connective tissue stroma, consist of numerous bundles of collagen fibers scattered between the various epithelial components (Fig. 12), this result is resemble with that mentioned by (21 and 30). The present findings revealed that the ultimobranchial gland in turkey characterized by different epithelial components including: C–cells, vesicles, parathyroid nodules and cystic structure (Fig. 12), similar to that mentioned by (12, 26, 29, 34 and 35).



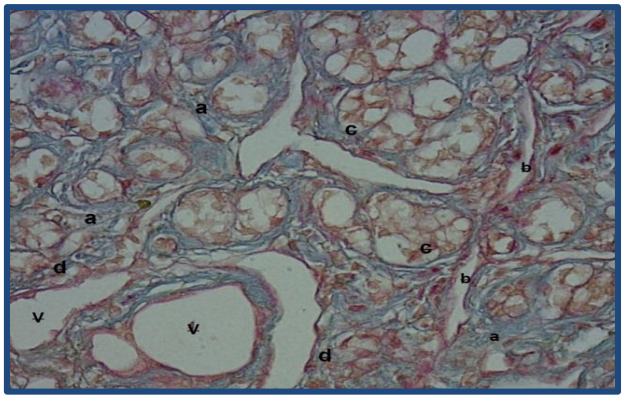
Figure, 10: Parathyroid gland showed: a- connective tissue sheath b- Chief cells c- Thin septa (H and E stain, 100 X).



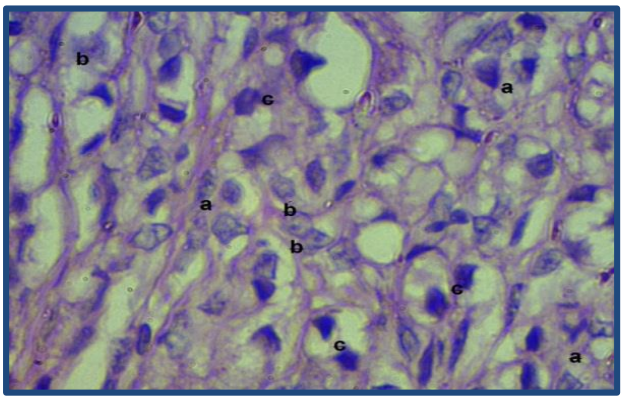
Figure, 11: Ultimobranchial showes: a-Very thin capsule of collagen fibers b- The thin capsule obscured on the other side c- Adipose connective tissue d- Blood vessels (Masson trichrome stain, 10 X).

The main components present in this study are the C–cells or calcitonin– producing cells which are the major proportion of the ultimobranchial gland (Fig. 12), as mentioned by (29, 36 and 37) these cells arranged as groups of 2-3 cells as well as the presence of loose cords scattered throughout the stroma (Fig. 13), these results are in agreement with the previous findings of (14, 21 and 38) in domestic fowl, and the C–cells have variable shapes: rounded, lanceolate or polygonal with rich blood supply (Fig. 13) resemble to that reported by (21, 26, 29 and 35). Some groups of C-cells have light cytoplasm and other

groups have dark cytoplasm (Fig. 13), these results were in agreement with (14, 29, 30 and 39), also the epithelial components in the turkey showed the presence of vesicles or follicular structures various in shape, size, structure and luminal contents, these vesicles may be found at any point of the gland surrounded by the groups of C–cells and separated by connective tissue stroma of collagen fibers and invaded by blood vessels (Fig. 12), these results are resemble to other domestic fowls mentioned by (14, 21 and 29).

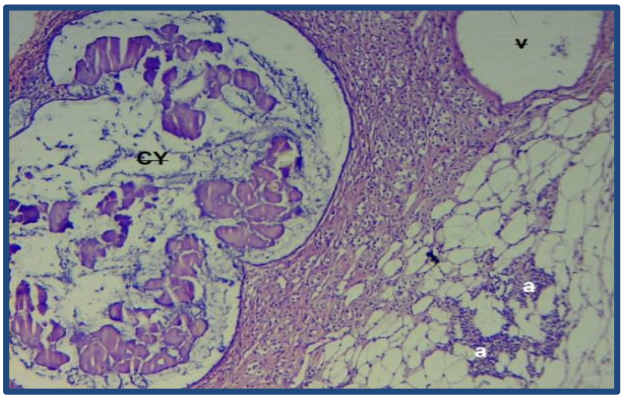


Figure, 12: Ultimobranchial gland showed: a- Collagen fibers b- Sinusoids c- Groups of C-cells d- The groups of C-cells showed adhesive attachment to the outer line of the vesicles (V) (Masson trichrome stain, 40 X).

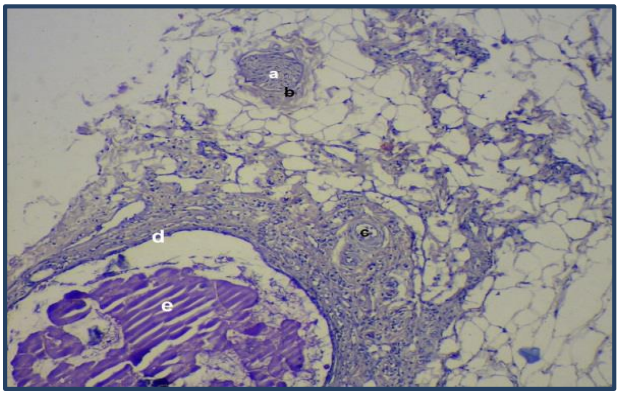


Figure, 13: Ultimobranchial gland shows: a- Groups of C-cells contain 2-3 cells with various shapes b- Light cytoplasm cells c- Dark cytoplasm cells (H and E stain, 100 X).

The present study revealed that the ultimobranchial gland had cystic structure which occupy the greater part of the gland, and it may be formed by the aggregation of some vesicles particularly the larger ones, these cysts were present with various shapes, sizes and luminal contents and with maturation it become a consistent feature of the ultimobronchial gland of the bird (Fig. 14), this result is resemble that mentioned by (29, 38 and 40), they usually rounded and lined by single layer of squamous or cuboidal epithelium (Fig. 15), the secretory products in their lumens were usually granular substances and colloid–like material which actively staining with PAS stain (Fig. 15). Also the ultimobranchial gland of turkey had some accessory parathyroid nodules which located mainly at the peripheral of the gland (Fig. 15), this result is resemble to the previous findings in other domestic fowls mentioned by (14, 21, and 29). Also the gland had areas of lymphatic infiltrations, mainly small lymphocyte of variable density but without germinal center, it can be found at any point of the gland but mainly located peripherally (Fig. 14), similar results have been reported by (9 and 14) in chicken, (29) in geese and (12) in pigeon. The gland was highly vascularide gland,the blood vessels distributed within the connective tissue stroma and around the C–cells and vesicles (Fig. 12 and 15), this result is parallel to that mentioned by (29, and 38- 40).



Figure, 14: Ultimobranchial gland showes: a- Lymphoid focci b- Cystic structure (CY) occupied the greater part of the gland (H and E stain, 10 X).



Figure, 15: Ultimobranchial gland shows: a-Accessory parathyroid nodule b- capsule c- Blood vessels d- Cystic structure e- Colloid secretion. (PAS stain, 10 X).

Table, 1: Dimensions of Thyroid gland in the Male and Female of local breed Turkey Meleagris gallopavo.

Parameters	Thyroid gland in Turkey Male		Thyroid gland in Turkey Female	
	Right gland mean± S.E	Left gland mean ± S.E	Right gland mean ± S.E	Left gland mean± S.E
Length (mm)	13.65 ± 1.96	14.28 ± 1.72	10.67 ± 1.30	11.3 ± 1. 28
Width (mm)	9.19 ± 2.18	11.2 ± 1.62	7.005 ± 0.826	7.84 ± 1.08
Weight (g)	0.4 ± 0.11	0.46 ± 0.15	0.078 ± 0.02	0.07 ± 0.01
Volume (Cm^3)	2.12 ± 0.33	2.47 ± 0.19	1.60 ± 0.115	1.70 ± 0.10

Table, 2: Dimensions of Parathyroid gland the Male and Female of local breed Turkey *Meleagris gallopavo*.

Parameters	Parathyroid gland in Turkey Male		Parathyroid gland in Turkey Female	
	Right gland mean± S.E	Left gland mean ± S.E	Right gland mean ± S.E	Left gland mean± S.E
Length (mm)	4.307± 0.09	4.81 ± 0.29	5.907± 0.89	6.628 ± 0.65
Width (mm)	2.952 ± 0.12	3.81 ± 0.30	4.463 ± 1.07	5.147 ± 0.86
Weight (g)	0.058 ± 0.02	0.09 ± 0.03	0.35±0.142	0.355 ± 0.12
Volume (Cm^3)	1.235 ± 0.02	1.16 ± 0.02	1.40 ± 0.085	1.453 ± 0.05

Table, 3: Dimensions of Ultimobranchial gland in the Male and Female of local breed Turkey *Meleagris gallopavo*.

Parameters	Ultimobranchial gland in Turkey Male		Ultimobranchial gland in Turkey Female	
	Right gland mean± S.E	Left gland mean ± S.E	Right gland mean ± S.E	Left gland mean± S.E
Length (mm)	6.033 ± 0.05	4.95 ± 0.04	6.038 ± 0.06	4.99 ± 0.073
Width (mm)	4.30 ± 0.042	3.56 ± 0.04	4.44 ± 0.091	3.68 ± 0.114
Weight (g)	0.05 ± 0.003	0.04 ± 0.004	0.05 ± 0.006	0.04 ± 0.005
Volume (Cm^3)	1.407 ± 0.03	1.332 ± 0.03	1.40 ± 0.036	1.33 ± 0.541

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دراسة تشريحية ونسجية للغدد الدرقية، جنيب الدرقية والغدة الغلصمية في السلالة العراقية المحلية للديك الرومي

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الخلاصة

صممت الدراسة الحالية لإظهار السمات التشريحية المميزة، الموقع، الشكل والحدود فضلا عن التركيب النسجي والمدد الدموي للغدد الدرقية، جنب الدرقية والغدة الغلصمية في السلالة المحلية من الديك الرومي. اثنا عشر طيرا من السلالة المحلية للديك الرومي من كلا الجنسين أخذت خالية من الامراض، قسمت الى مجموعتين متساويتين (ستة للدراسة التشريحية وستة للدراسة النسجية)، وقسمت كل مجموعة بواقع (ثلاث ذكور وثلاث اناث) لكل دراسة. وتم اجراء بعض القياسات التشريحية للغدد الثلاث والتي شملت: الطول، العرض، الوزن والحجم كذلك الوصف العياني اضافة الى الموقع التشريحي لكل غدة مع حدودها والمدد الدموي للغدد الثلاث. تمتلك السلالة المحلية من الديك الرومي زوجا متناظرا من الغدة الدرقية، تقع في مدخل الصدر وتكون قريبة جدا من الشريان السباتي العام، وتزود الغدة الدرقية بالمدد الدموي عن طريق ثلاث شرايين هي: الشريان الدرقي القحفي او الأمامي، الشريان الدرقي الأوسط والشريان الدرقي الخلفي او الظهري، وكان متوسط الطول، العرض، الوزن وحجم الغدة الدرقية في الديك الرومي في الذكور أعلى منها في الإناث والغدة نسجيا محاطة بمحفظة رقيقة من الألياف الغراوية، وتتألف من جريبات كروية مبطنة بطبقة واحدة من الخلايا الظهارية وتحيط بتجاويف مليئة بالإفراز الغروي للغدة وتحتوي الغدة على عقيدات جنيب الدرقية بين جريباتها. كذلك يمتلك الديك الرومي زوج غير متناظر من الغدد جنيب الدرقية، تكون الغدة جنب الدرقية اليمنى مجاورة للغدة الدرقية اليمنى بينما تكون الغدة اليسرى مفصولة عن الغدة الدرقية اليسرى لكن متاخمة للغدة الغلصمية اليسرى أنسيا للشريان السباتي العام، وأظهرت الدراسة ان الغدة جنب الدرقية في الديك الرومي كانت غدة مفردة في كل جانب من جانبي الجسم في كل عينات الدراسة، وكان المدد الدموي للغدة عن طريق شريانين جنب درقيين احدهما يتفرع من الشريان الدرقي الامامي والآخر يتفرع من الشريان المريئي القصبي الغلصمي. وكان متوسط الطول، العرض، الوزن والحجم للغدة جنب الدرقية في الديك الرومي في الاناث أعلى منها في الذكور. تحاط الغدة جنب الدرقية نسجيا بمحفظة الألياف الغراوية وتتألف من حبال غير منتظمة متفممة ومتفرعة من الخلايا الرئيسية مفصولة بواسطة حواجز رقيقة من النسيج الضام وتكون هذه الحبال بشكل مشعع حول جيبانيات مركزية. أما الغدة الغلصمية، حيث يمتلك الديك الرومي زوجا من الغدد الغلصمية تقعان على جانبي القصبة الهوائية ظهريا للغدة جنب الدرقية ومجاورة لتفرع الشريان العضدي الرأسي، وتزود بالدم كما في الغدة جنب الدرقية عن طريق فرع جانبي ينشأ من الشريان المريئي القصبي الغلصمي. وتتألف الغدة نسيجيا من مكونات ظهارية مختلفة تشتمل على: الخلايا الظهارية المسماة بـ (الخلايا السينية) التي تنتظم على شكل مجاميع وحبال رخوة من الخلايا، عقيدات جنيب الدرقية وكذلك تراكيب جريبية على شكل حويصلات مختلفة الاشكال والاحجام والتي يتحد عدد منها لتكوين تركيب كيسي كبير يشغل معظم متن الغدة وكان متوسط الطول، العرض، الوزن وحجم الغدة الغلصمية في الديك الرومي ذات قيم متساوية بين الذكور والإناث.

الكلمات المفتاحية: الغدة الدرقية للديك الرومي، الغدة جنيب الدرقية للديك الرومي، الغدة الغلصمية للديك الرومي.