

Histomorphological investigations of some endocrine glands in peacock "*Pavo cristatus*"

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Abstract

Aims: to determine the location, shape and boundaries, in addition to the histological structures of some endocrine organs in the Peacock such as: Thyroid, Parathyroid and adrenal gland by absolute eyes and light microscope and leads to establish a definite description of these glands.

Methods: ten adult healthy Peacock birds were taken and divided into two groups: anatomical and histological

Results : Anatomically Peacock had a pair of symmetrical thyroid glands of spherical shape, dark red or reddish-brown color, lie at the end of neck parallel to trachea, in between jugular vein and common carotid artery. Peacock also had a pair of parathyroid glands, symmetrically location, each had cranial and caudal part, which were seen slightly separated from each other on the right side, while they were adhered to each other forming a single gland on the left side, while the adrenal glands appeared paired small structures positioned inside the celome on two sides of the median line beside the cranial poles of kidneys with a color ranged from yellowish to reddish-yellow. Histologically, thyroid parenchyma consisted of spherical follicles, and according to epithelial type, shape and colloid's nature inside them, follicles categorized into very active, in-active and active follicles. Parathyroid parenchyma comprised irregular anastomosing and branching cords composed of one type of cells the faintly stained chief cells. Adrenal parenchyma showed cortex intermingled with medulla and divided into two zones, peripheral and central.

Key words: Peacock, Thyroid, Parathyroid, Adrenal, Anatomy, Histology.



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Introduction

Peafowl is a common name for three species of resplendent birds of the pheasant family. Peacock is a term referred to the male and also peahen mentioned the female. The most familiar type of peafowl was the Indian or the blue peacock "Pavo cristatus" that originated back to Sri Lanka and India(1). The female is similar to the male in size but without the train and ornament of the head and differs slightly in color(2). The Indian peafowl is the largest among all the pheasants and known as the national bird of India. The peacock is one of the best showiest of all birds because of its great size and the beauty of its feathers(3). All living beings are able to taking up iodine and integrating it into proteins. Iodinated compounds are important in controlling various functions in invertebrates lacking thyroid gland. In humans and most vertebrates, thyroid gland has developed to save and store iodine and produces iodinated molecules, such as iodothyronines, that containing thyroid hormones(4). The parathyroid glands secrete and produce PTH, as a reply to low blood calcium levels, that lead to calcium withdrawal from bones by exciting osteoclasts to produce the needed enzymes to destroy bones and release calcium to the interstitial fluid, also this hormone discouraged osteoblasts, that participate in bone deposition, thus sparing calcium in blood, it lead to heighten reabsorption of calcium and magnesium in the kidney from the filtrated urine(5). The importance of adrenal gland in animals generally is the maintaining of homeostasis and playing a vital role in all types of responses to the stress and immune-functions also it controls the pressure of blood (6-9) and in birds

especially because the elimination of adrenal glands causes bird's death ultimately(10). Adrenal glands in mammals and birds were Similar, both were complex morphologically and functionally(11), and the differences between them were in the function depending on cortical and medullary arrangement which was intermingled in birds, without definite cortex or medulla. (12). Avian hormone production from adrenal glands happens at the cortex which produce corticosterones and aldosterones whilst the catecholamines are produced in medulla(13). This study is achieved to determine the location, shape and boundaries, in addition to the histological structures of some Peacock's endocrine organs such as: Thyroid, Parathyroid and adrenal gland by absolute eyes and light microscope to establish a definite description of these glands.

Materials and Methods

The study was achieved on six adult Peacock birds divided into two groups anatomical and histological, the birds were slaughtered with legitimate way (halal method), the macroscopic dissection was done to study the anatomical location and description of the glands with its boundaries (Fig. 1), and photographed it, as well as the recorded of color and shape of the glands. While in the histological examination, the thyroid and parathyroid specimens were collected immediately after slaughtered and treated by using the routine histological techniques(14).

Results

Anatomical Results:

Thyroid glands: The present work showed that the Peacock had a pair of thyroid glands, symmetrically in location, lie at the base of the neck parallel to the trachea between the jugular vein and the common carotid artery in the thoracic inlet. The thyroid gland appeared oval to spherical in shape, dark red or reddish – brown in color (Fig. 2), slightly in contact with the caudal lobe of thymus gland that located on the sides of trachea.

Parathyroid glands: Peacock had a pair of parathyroid glands, symmetrically location, each gland possess two parts (cranial and caudal parathyroid), they were seen slightly separated from each other on the right side, while they were adhered to each other to form a single gland on the left side, they were rounded to oval shape, yellowish to yellowish – brown in color (Fig. 2,3)

Each parathyroid gland located either neighboring -or nearest the caudal pole of thyroid gland in the end of neck laterally to common carotid artery directly on top of the junction of brachiocephalic artery (Fig. 2).

Adrenal glands: The adrenal glands of peacock appeared as paired small structures positioned inside the celome on two sides of the mid line of the body cranially to left and right kidneys and caudally to both right and left lungs just anteriorly for the bifurcation of caudal vena cava. Right adrenal differs from left gland in the shape, it was roughly pyramidal with a caudal pointing apex, differed from the left one which was flattened and elongated dorso-ventrally, also they displayed difference in their color ranged between reddish-yellow to greyish-yellow (Fig.4,5).

Statistical Analysis

The data were intended by Statistical Package for the Social Sciences for Windows version 17 (SPSS, Armonk, NY: IBM Corp.). We used T test to calculate the differences inside taken groups whilst ANOVA test was used to calculate the differences between parameters of the taken groups. Also we used Pearson's correlation coefficient for the association between each parameters and weight of adrenal gland. The P value was set ≤ 0.05 and ≤ 0.01 (two tailed) to be significant statistically.

Table (1): Comparative & Descriptive statistic of **Right Thyroid** in males & females

parameters	Male Right Thyroid	Female Right Thyroid	
	Mean± SE	Mean± SE	T test P value
length(mm)	13.65±1.13161	10.67 ±0.75056	0.093214
width(mm)	9.19 ± 1.25862	7.0050±0.47689	0.179826
weight(g)	0.40±0.06351	0.0780±0.01155	0.007552*
Volume (cm³)	2.12±0.19053	1.60±0.06640	0.061504

*significant difference (p value <0.05)

As shown in table (1), there was significant difference between right thyroid of males and females regarding the weight (g).

Table (2): comparative & Descriptive statistic of **Left Thyroid** in males & females

parameters	Male Left Thyroid	Female Left Thyroid	
	Mean± SE	Mean± SE	T test P value
length(mm)	14.280±0.993042	11.300±0.739008	0.073762
width(mm)	11.200±0.935307	7.840±0.623538	0.040376*
weight(g)	0.460±0.086603	0.070±0.005774	0.010878*
Volume (cm³)	2.470±0.109697	1.700±0.057735	0.003418*

*significant difference (p value <0.05)

As shown in table (2), there was significant difference between left thyroid of males and females regarding the length (mm), width (mm), weight (g) and Volume (cm³).

Table (3): comparative & Descriptive statistic of **Right Parathyroid** in males & females

parameters	Male Right Parathyroid	Female Right Parathyroid	
	Mean± SE	Mean± SE	T test P value
length(mm)	4.3070±0.05196	5.907±0.513842	0.0362915*
width(mm)	2.9520±0.06928	4.463±0.617765	0.0719284
weight(g)	0.0580±0.01155	0.350±0.081984	0.024299*
Volume (cm³)	1.2350±0.01155	1.400±0.049075	0.030707*

*significant difference (p value <0.05)

As shown in table (3), there was significant difference between right parathyroid of males and females regarding the length (mm), weight (g) and Volume (cm³).

Table (4): comparative & Descriptive statistic of **Left Parathyroid** in males & females

parameters	Male Left Parathyroid	Female Left Parathyroid	
	Mean± SE	Mean± SE	T test P value
length(mm)	4.810±0.167432	6.628±0.375278	0.0114746*
width(mm)	3.810± 0.173205	5.147± 0.496521	0.0638126
weight(g)	0.090± 0.017321	0.355± 0.069282	0.0206406*
Volume (cm³)	1.160± 0.011547	1.453± 0.028868	0.0007068**

*significant difference (p value <0.05)

** High significant difference (p value <0.001)

As shown in table (4), there was significant difference between left parathyroid of males and females regarding the length (mm), weight (g) and Volume (cm³).

Table (5): Right and Left Adrenal gland differences in peacock

parameters	Right Adrenal Gland	Left Adrenal Gland	T test P value
	Mean± SE	Mean± SE	

length(mm)	8.452±0.04196	9.264±0.513742	0.026*
width(mm)	4.224± 0.174205	4.538± 0.497521	0.336603
weight(g)	0.45±0.06828	0.524±0.616765	0.505523
Thickness (mm)	3.234± 1.25762	3.156±0.47789	0.394628

As table (5) referred, a Significant differences have been recorded between left and right adrenal glands' length in peacock (p value = 0.026). No significant difference was recorded between adrenal glands' width (p value = 0.336603). No Significant difference was recorded between left and right adrenal glands' weight (p value = 0.505523). No Significant difference was recorded between adrenal glands' thickness (p value = 0.394628).

Histological Results

Thyroid gland in the Peacock was surrounded by a delicate connective tissue capsule which completely surrounds the gland. Connective tissue septa extend from it and penetrate the gland. Thyroid parenchyma involved spherical follicles, contained slight interstitial tissue in between them; each follicle is enclosing a cavity occupied with colloid (Fig. 5). Follicles were each bordered by a cuboidal epithelium (Fig. 6), and according to epithelial type, shape and colloid's nature inside them, follicles categorized into very active, in-active and active follicles. The first type was quite small, spherical follicles lined by low columnar to cuboidal epithelium with centrally located nucleus and vacuolated colloid secretion, while the active follicles were slightly larger but reduced in the height of epithelium (cuboidal or low cuboidal epithelium) with rounded nucleus and colloid in the lumen, in the other hand inactive follicles were lined by epithelium ranges from low cuboidal to simple squamous (Fig.7)

Parathyroid glands were bounded by connective tissue capsule made of collagen fibers with associated fibroblasts, that send thin septa of connective tissue contained numerous

blood vessels and sinusoids, the gland parenchyma was consist of irregular branching and anastomosing cords of chief cells (Fig. 8), also the parenchyma showed that the gland was composed of one type of cells the faintly stained chief cells, rounded to oval in shape, surrounded by a sheath of connective tissue forming an anastomosing cords that attempt to grouped themselves around a central sinusoid and being radiated about these sinusoids (Fig.9).

Adrenal gland appeared covered by a capsule of connective tissue was rich with collagen, and few elastic fibers. The parenchyma was different from the mammals the latter showed an outer cortex and inner medulla and cortex contain three zones: glomerulosa, fasciculata and reticularis zones while the former as viewed in this study had intermingled tissue of cortex and medulla and the cortex divided into two zones; peripheral zone or (sub capsular zone SCZ) and inner or central zone CZ (Fig.11). SCZ cells were placed immediately below the gland's capsule and set as anastomosing arched cords intermixed with groups of medullary cells. Cells inside the cords were high columnar acidophilic cells contained small rounded central nucleus (Fig.12). While, central zone showed randomly arranged cords composed of cells lined

by columnar epithelium of basal situated nuclei encircling with medullary cells. The other kind of cells found in the CZ called chromaffin or medullary cells which were irregular

clusters of cells mingled among cortical cells. Their shape was polygonal or rounded shape contained dark and large rounded nuclei (Fig.13).



Fig. (1): Photograph showed Peacock: **A-** before slaughtering **B,C-** after dissecting.

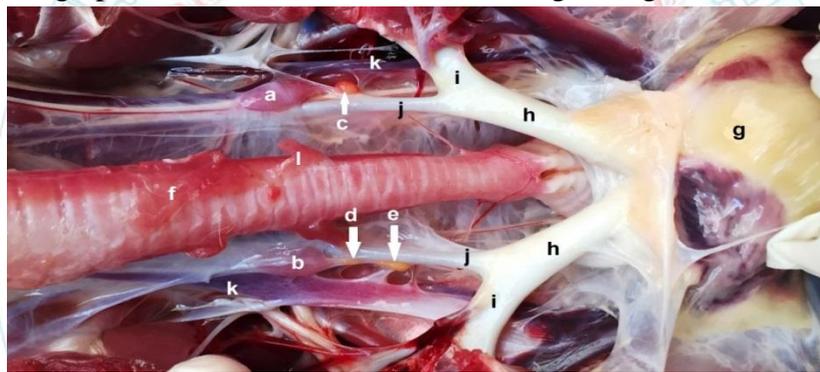


Fig. (2): Photograph in Peacock showed: **a- Left Thyroid gl. b- Right Thyroid gl. c- Left Parathyroid gl. d- cranial lobe of R. Parathyroid gl. e- caudal lobe of R. Parathyroid gl. f-Trachea g-Heart h- Brachiocephalic artery i- Subclavian artery j- Common carotid artery k- Jugular vein l- Sternotracheal muscle.**

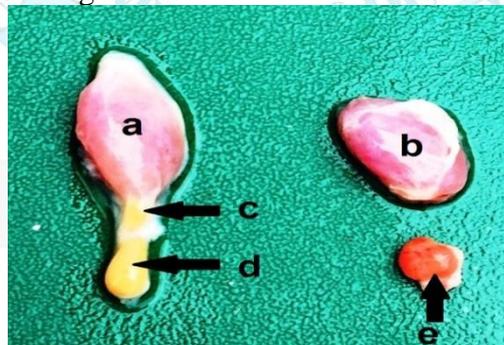


Fig. (3): Photograph showed: **a- Right Thyroid gl. b- Left Thyroid gl. c- Cranial lobe of Right Parathyroid gl. d- Caudal lobe of Right Parathyroid gl. e- Adhered cranial and caudal left Parathyroid glands.**

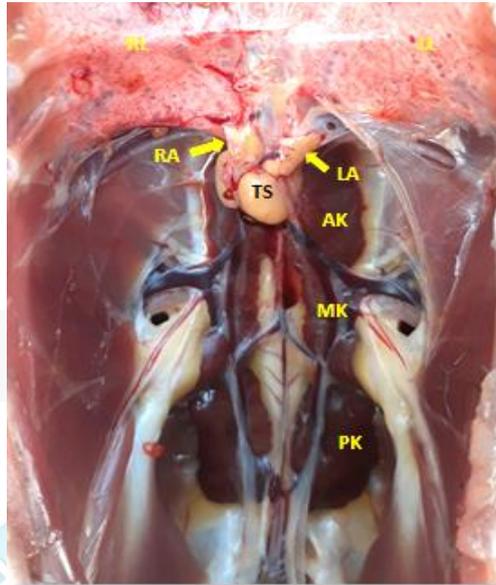


Fig. (4): Photograph in Peacock showed: **RL:** right lung, **LL:** left lungs, **RA and LA:** right and left adrenal gl., **TS:** testis, **AK, MK, PK:** Anterior, middle and posterior lobes of kidney.

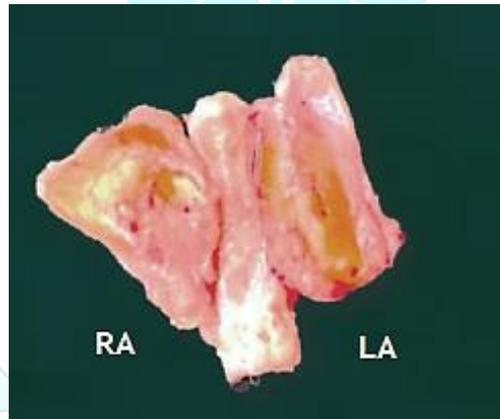


Fig. (5): Photograph showed RA: right adrenal gl. LA: left adrenal gl. in Peacock immersed in the connective tissue.

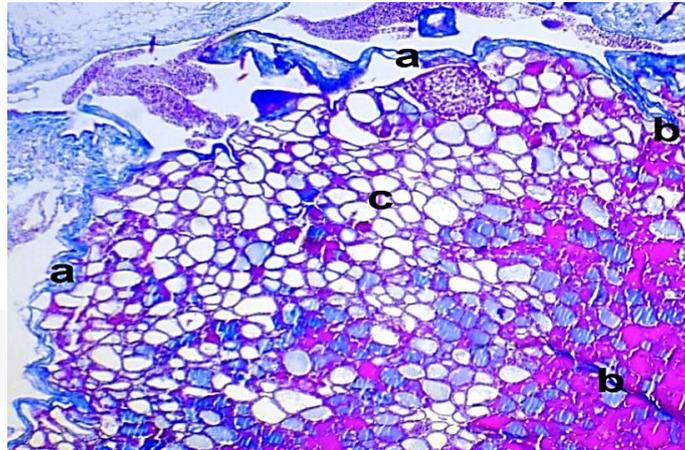


Fig. (6): Histological section of thyroid gland showed: **a-** Collagenous capsule **b-** connective tissue septa **c-** thyroid follicles (Masson trichrome stain, 40 X).

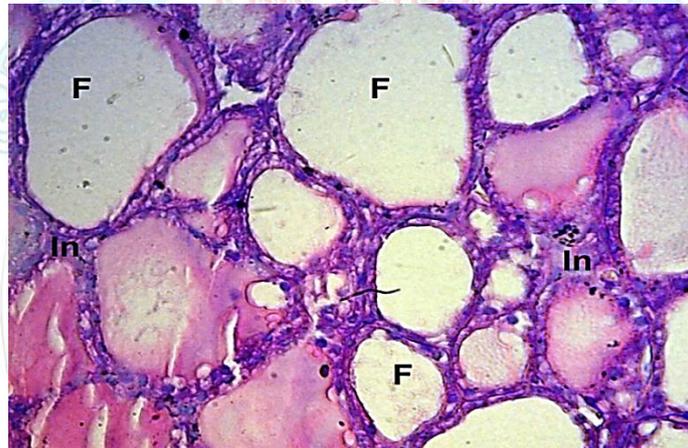


Fig. (7): Histological section of thyroid gland showed: **F:** Thyroid follicles lined by simple cuboidal epithelium **In:** interstitial tissue (H & E stain, 400 X).

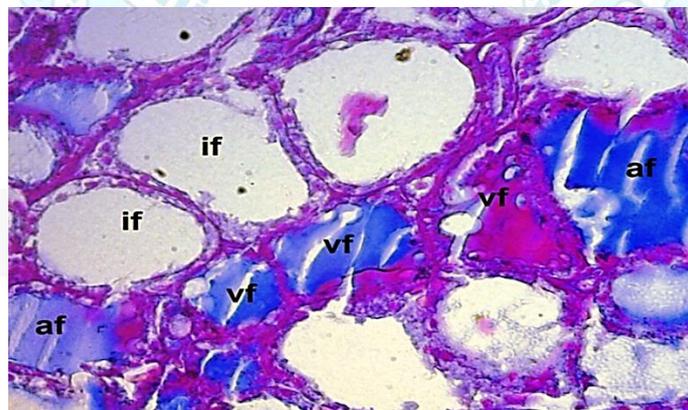


Fig.(8): Histological section of thyroid gland showed: **vf- very active follicles:** high cuboidal epi. **af- active follicles:** cuboidal epi. **if- inactive follicles:** low cuboidal epi. (Masson trichrome stain, 400 X).

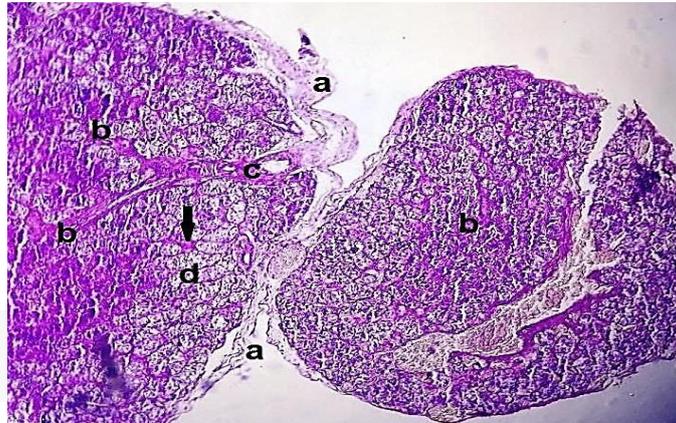


Fig.(9): Histological section showed two lobes of parathyroid gland: **a-** Capsule **b-** thin septa containing **c-** blood vessels **d-** chief cells radiated around sinusoids (**arrow head**) (H & E stain, 100 X).

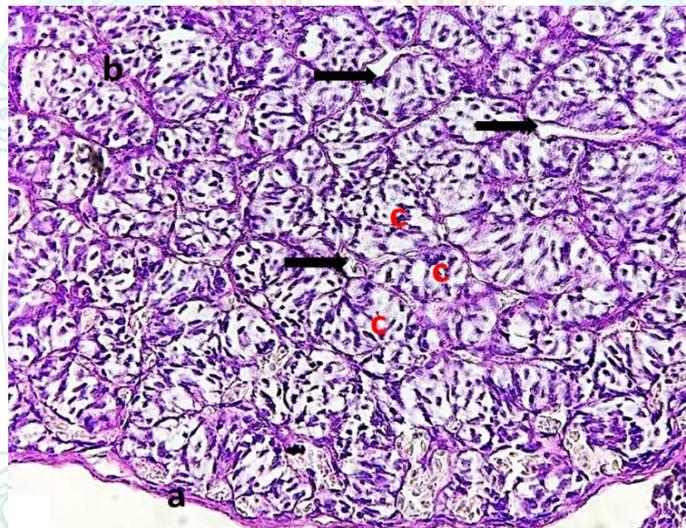


Fig.(10): Histological section of parathyroid gland showed: **a-** capsule **b-** interstitial tissue **c-** cords of chief cells, sinusoids (**arrow heads**) (H & E stain, 400 X).

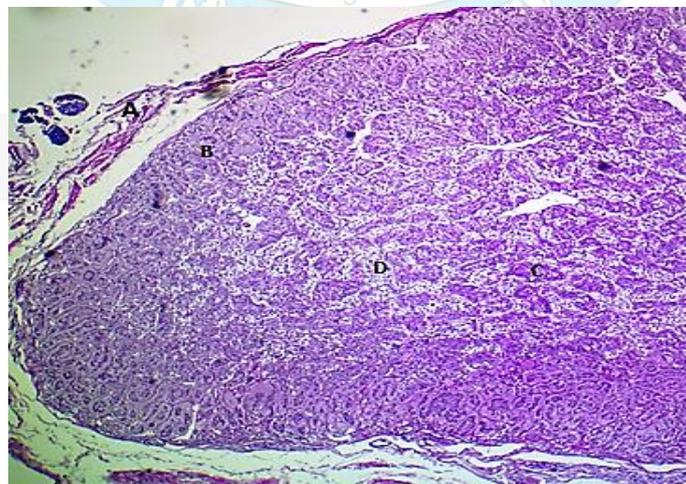


Fig.(11): Histological section of adrenal gland in Peacock showed: A- capsule B: sub capsular zone C: central zone D: medullary tissue. (H&E stain 40 X).



Fig.(12): Histological section of adrenal gland in Peacock showed: c- capsule SCZ- sub capsular zone, S- Sinusoids (H&E stain 400X).

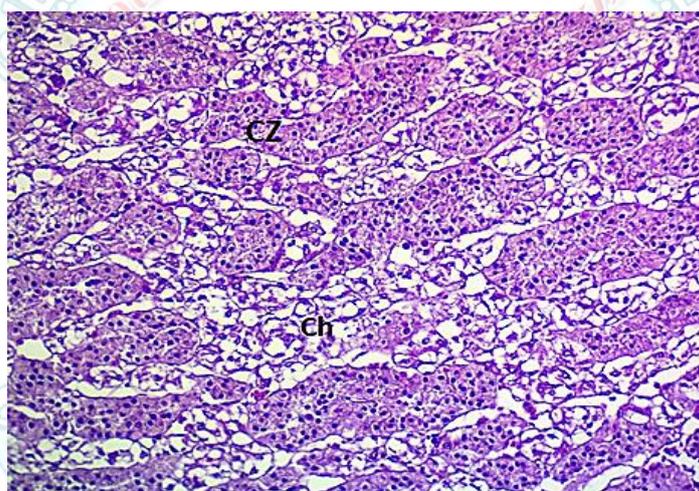


Fig.(13): Histological section of adrenal gland in Peacock showed: CZ: central zone and Ch: chromaffin cells (H&E stain 400 X).

Discussion

Anatomical Discussion

The anatomical results of the present work in the Peacock showed the number of thyroid glands and their location, parallel to previous findings in other

domestic fowls mentioned by (15) in duck, (16) in pigeon. The shape, color and boundaries of thyroid glands in the Peacock similar to its shape and color were previously mentioned in other avian species as reported by (17), in chicken, (18) in duck. Our

findings in this study revealed that the number of parathyroid glands and number of parts that each gland possess and the symmetrically of the glands on each side were in agreement with that mentioned by (19) in domestic fowl, (20) in grey quail, (16) in pigeon, and disagreement with (21) in long - legged buzzard who mentioned that parathyroid gland appeared as a single gland at right whilst it had two parts: anterior and posterior at left side. There is a similarity in the position and boundaries of parathyroid gland in the current study with (22) in chicken, (20) in grey quail, (23) in kuttanad duck. The shape and color similar to its description as mentioned by (24) in chicken; (19) in domestic fowls. There was a similarity in the variation of adrenal shape and location in peacock with that mentioned by (9) in Chicken; (8) in duck. They also showed variation in color so, the shape and color variation in peacock was parallel to the previous findings of (25) in duck.

Histological Discussion:

The current histological study indicated that thyroid architecture

in Peacock was resemble to findings of (24) in domestic fowl and (15) in kuttanad duck. Thyroid follicles vary in their shapes and sizes and these differences may attributable to numerous reasons like season, species, sex, age, diet, secretory activity and climate and the follicles were outlined by cuboidal epithelium, classification of follicles resemble to the previous findings mentioned by (26) in ostrich and (15) in duck. The histological architecture of the parathyroid glands obtained in the present study in the Peacock were in agreement with the previous finding in the domestic fowls mentioned by (27) in chicken, (16) in pigeon, (23) in duck. The composition of the parenchyma of parathyroid gland was similar to their shape in other domestic fowls mentioned by (22) in chicken, (16, 28) in pigeon, (23) in duck. Adrenal gland in peacock was surrounded from outside capsule similar to (9) in chicken; (29) in ostrich. The findings of parenchyma were parallel to that in most birds like in chicken and domestic fowl (12), geese (30). The adrenal cortical results were in accordance with those of (31) in duck; (29) in Chicken; although (8) and (32) mentioned that adrenal of chicken was contained three zones. The results

of the SCZ were in accordance with those of(32-34); in geese; (35) in Chicken. While, the inner cortical cells results were similar to that reported by (8) in Chicken;(31) in duck. In the other hand, the other kind of cells inside inner zone were parallel to results reported by(34) in quail, (33) in turkey. That appeared in as small groups of islets with dark-bluish color, these results were parallel with (30) in geese.

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