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A COMPARATIVE HISTOLOGICAL STUDY OF THYROID TISSUE IN CARP FISH *CYPRINUS CARPSIO* AND MICE *SWISS ALBICANS*

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ABSTRACT

This histological study was carried out to compare between the thyroid gland of mice (as a model of the mammals) and the thyroid tissue of fish. Unlike mice, the thyroid gland of fish can't be recognized by naked eye. The present study revealed that the thyroid of mice varied from that of fish by the location and the histological structure. The study classified the physiological state of the thyroid of mice into three states and that of the fish into only two states. Accordingly, the study concluded that the metabolism of thyroid fish was of moderate type.

Key words: Carp fish, Histological, Metabolism, Mice, Thyroid.

INTRODCTION

In adult vertebrates, the thyroid gland is a butterfly-shaped endocrine organ that consists of right and left lobes binding by intermediate isthmus (Dellmann and Brown, 1987). It is located in the cervical region dorsolaterally next to the trachea near (inferior to) the level of the larynx. It is covered by a connective tissue capsule that internally branches into very narrow septae that divides it into lobes (Kameda *et al*, 2007; Steinberg, 2008). The thyroid parenchyma is composed of two cell types: the follicular cells which lines each follicle, and the para follicular cells which exists between adjacent follicles. These cells are also referred to as C cells or clear cells because of their pale staining cytoplasm (Aughey and Frye, 2010).The size of the thyroid follicle ranges from 50 to 200 *um* in diameter (Samuelson, 2007; Mesher, 2010). On the other hand, the thyroid tissue in the fishes is organized as diffuse follicles with a few exceptions (Genten *et al*, 2009), rather than as an encapsulated gland as it is found in most other vertebrate species. The follicles of thyroid gland migrate to distant unusual locations such as liver, kidney, eye, gut, spleen, gonad etc (Pandey and Shukla, 2007). The shape of thyroid was variable depending on various fish group. In cyclostomes, it takes the form of follicles. In many Teleosts it becomes like diffused structure as small masses of follicles. In elasmobranches and bony fishes, thyroid is compact structure (Oguri, 1990; Geven *et al.*, 2007). The molecules components of the hypothalamic-pituitary-thyroid (HPT) axis in fish correspond closely to those of mammals (Blanton and Specker, 2007). Power *et al*. (2001) revealed that the thyroid hormones are present in high quantities in fish eggs and presumably of maternal origin. Evidences are presented that thyroid hormones can modify the pattern and magnitude of stress response in fishes as it modifies either its own actions or the action of stress hormones (Peter, 2011; Silva, 2006). The aim of this study is to focus the light on the developmental histological differences of thyroid between the fish and mice.

MATERIALS AND METHODS

Samples of thyroid gland from sub-pharyngeal region, head kidney and kidney of six adult female carp fish were obtained from Tigris River. Samples from thyroid glands of eight adult female mice were also collected from Iraq natural history museum in Baghdad. Both samples were collected in spring of 2015; all samples were fixed in Neutral buffered formalin 10% for two days. Tissue samples were dehydrated in a graded series of ethanol, embedded in paraffin, sectioned at 7 um thick, stained with hematoxylin & Eosin and PAS stains. (Suvarna *et al*., 2013). Light microscope was used in inspection. All the images were uploaded into a computer by means of a digital camera (MEM 1300) through the microscope (Ballesteros *et al*., 2012).

RESULTS AND DISCUSSION

The current study found that the building up of the thyroid gland of mice was more developed than that of fish. It was a single compact gland consisting of right and left lobes linked by intermediate isthmus located on the ventral surface of the trachea and covered by a connective tissue capsule (Fig.1). On the other hand, the thyroid tissue of fish was not localized compact structure, their thyroid follicles were scattered on more than one organ across the body (Fig.2 &3) especially the renal tissue and the subpharyngeal regions (around the ventral aorta). They appeared as diffuse small masses rather than encapsulated localized gland., Despite the similarity between the general fundamental building of the thyroid In both mice and fish, the building up of the thyroid follicles in fish was more simple (Fig. 3). These follicles were variable in size and shape and were separated by a fine loose fibrovascular connective tissue. The shapes were mostly spherical or ovoid, the sizes were small, medium or large .Unlike mice, the follicular epithelium was not well-established. However, the thyroid follicular cells of carp fish form tight uniform epithelium. Most follicular cells of carp fish were only of squamous or cuboidal type, columnar cells were not recorded. Parafollicular clear cells (C- cells) were clearly observed in both mice and fish (Fig.4 & 5). Reabsorption vacuoles were seen on the luminal surfaces of active follicular cells of mice (Fig.4). Unlike mice, clear basement membrane was not observed around the thyroid follicles of carp fish (Fig.6). The thyroid follicles presented different physiological states in the shape, height of the follicular cells, and amount and consistency of colloid. Within each follicle of mice, we can see more than one cellular height, and consequently, the three physiological statuses (Hypoactive, active, and hyperactive) were recorded (Ganong, 2005; Samuelson, 2007). This is rarely observed in the follicle of carp fish. The functional unit of thyroid gland in carp fish had only two states, hypoactive and active, hyperactive state was not registered. The hypoactive state had flattened to squamous epithelium and the follicles were mostly filled with dense eosinophilic colloid. The active state whose follicular cells were low to high cuboidal and the follicles were nearly-filled with slightly basophilic diluted colloid. The study confirmed by the findings of Genten *et al*. (2009) and Al-Adhami and Al-Bakri (1999) who revealed that the thyroid of Carp fish was of diffused type and its activity was judged by its histology and the follicles increase in size by coalescence between each other. The study believed that the simplicity of the circulatory system in carp fish may explain the unique distribution of the thyroid tissue in this way. This could be attributed to the fact that any ductless endocrine glands need abundant blood supply to transport their secretion far away from the site of release from the thyroid tissue to the different organs of the body. The heart of the fish composed only of two chambers and the circulatory system includes only one circulation and the blood passes through the blood capillaries to the gills and then to the tissues of the body, this is called the single circulation. The endocrine glands whose cells secrete their products directly into the blood stream need abundant blood supply to transport their secretion to the target organs (Dellmann and Brown, 1987). The thyroid tissue possibly was scattered into different thyroid structures as an ecological adaptation to supply the hormone into different regions of the body. On the other hand, oxygen is more readily available to terrestrial vertebrates than it is to fishes as air contains much more oxygen that can dissolve in an equivalent volume of water.

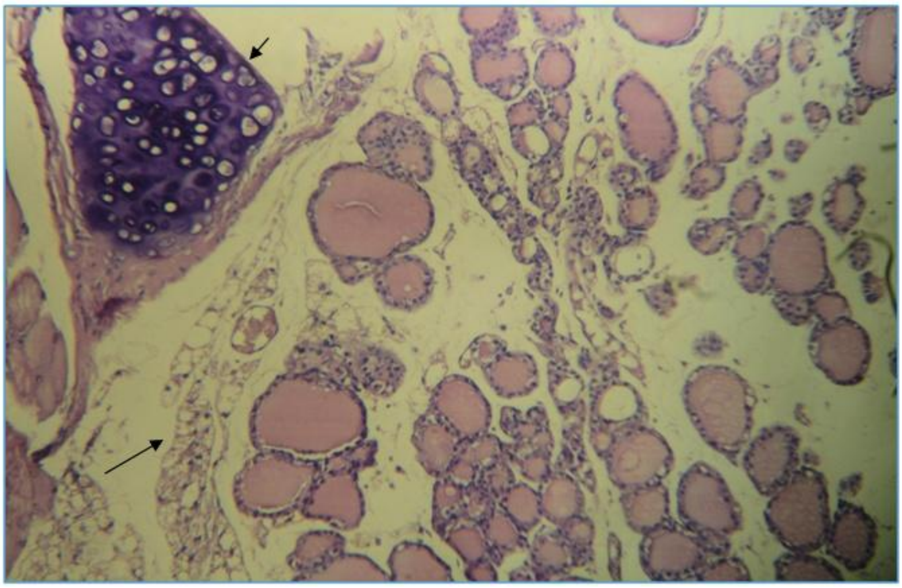

Figure (1): Thyroid gland of mice contained many follicles surrounded by well developed connective tissue capsule (long arrow). Note the hyaline cartilage of trachea (short arrow). (X200. H&E stain).

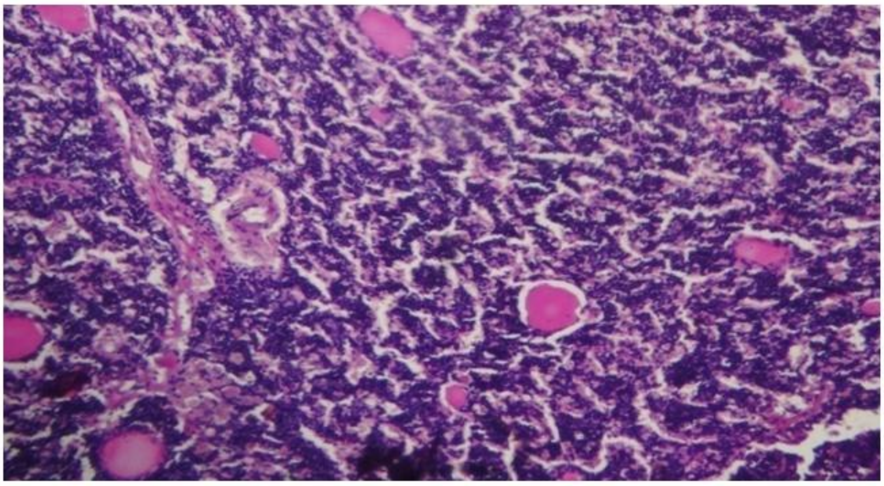

Figure (2): Thyroid gland of fish filled with homogenous colloid thyroid follicles embedded in the parenchyma of head of kidney. Notice the absence of connective tissue capsule. (X100. H&E stain).

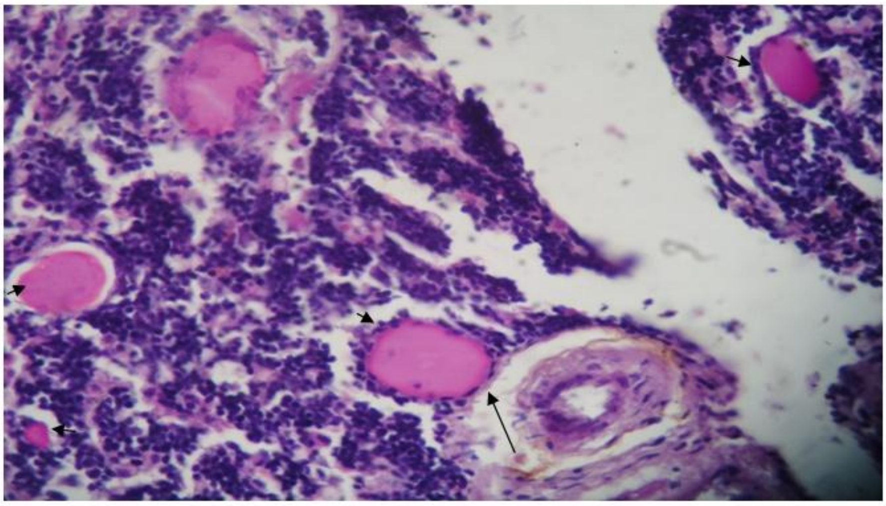

Figure (3): Thyroid of Carp fish shows small, medium and large thyroid follicles (small arrows) in the sub pharyngeal region filled with homogenous colloid, the building of follicular cells were weak. Notice the relationship between one follicle and the blood vessel (Large arrow). (X400. H&E stain).

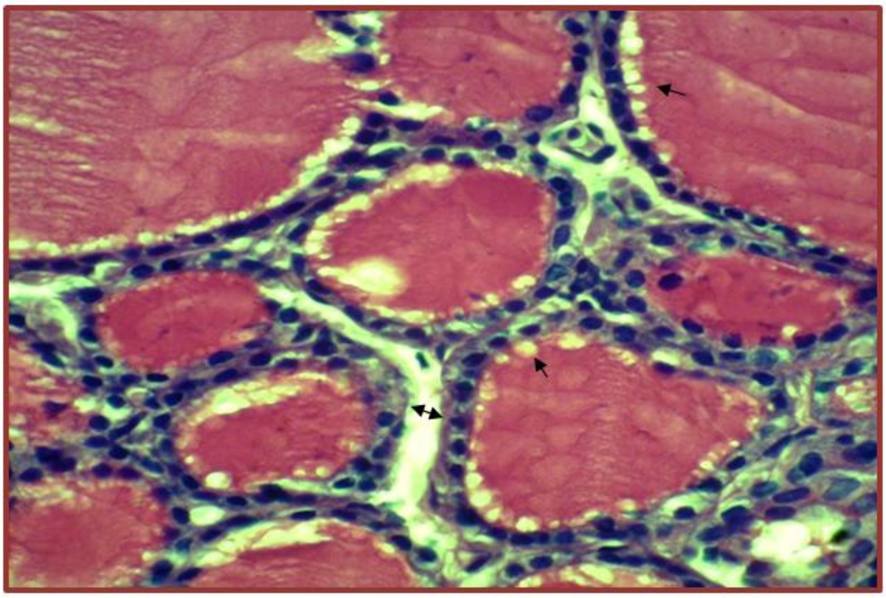

Figure (4): Thyroid follicles of mice. Note the prominent basement membrane around each follicle (double- head arrow). The absorptive vacuoles are seen over the luminal surface of the follicular cells (short arrows). X400. PAS stain.

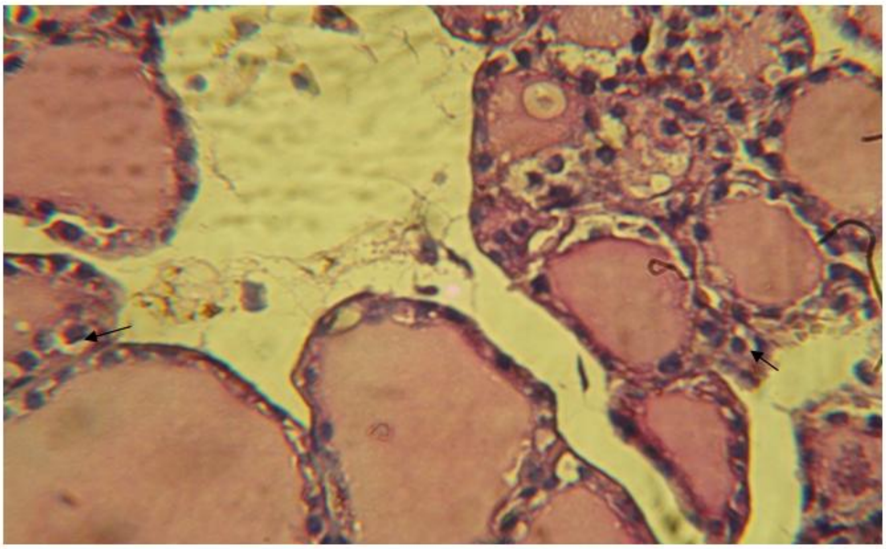

Figure (5): Thyroid follicles of mice filled with colloid. Note the C-cell (arrows) lies among the follicles. (X400 H&E stain).

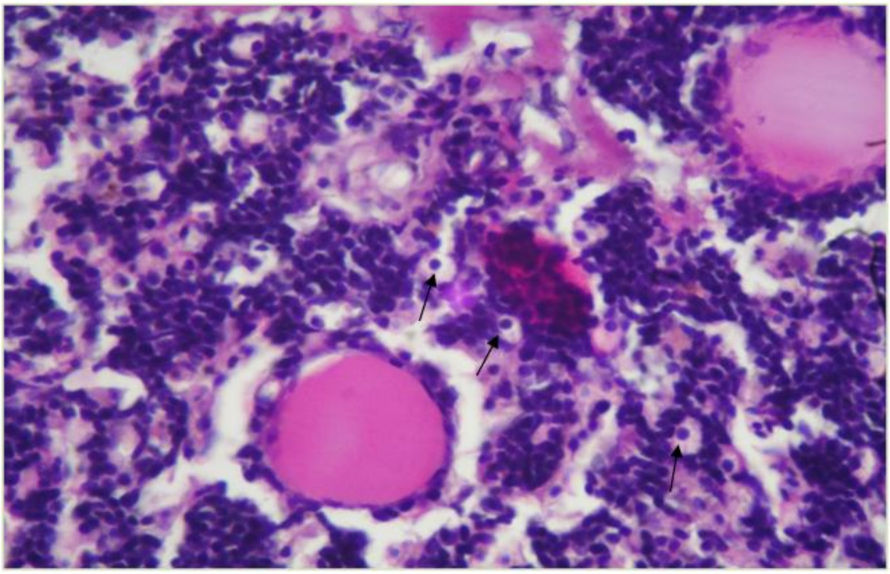

Figure (6): Two large thyroid follicles of fish. Notice many clear cells (C- cells) lie near the follicles (arrows). Notice the weak building of the follicular cells. (X400. H&E stain).

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دراسة نسجية مقارنة بين الغدة الدرقية في أسماك الكارب *Cyprinus carpio* والفأر *Swiss albicans*

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الخلاصة

أجريت هذه الدراسة للمقارنة النسجية بين درقية الفأر (كأنموذج للبائن) وبين النسيج الدرقي في أسماك الكارب. أظهرت الدراسة أنه خلافا لما موجود في الفأر، فإن درقية الأسماك لا يمكن مشاهدتها بالعين المجردة . تختلف درقية الفأر عن درقية اسماك الكارب في الموقع والتركيب النسجي. صنفت الدراسة النشاط الوظيفي في درقية الفأر الى ثلاث حالات، وفي الأسماك الى حالتي نشاط فقط وطبقا لذلك إستنتجت الدراسة إن الأيض في أسماك الكارب يكون من النوع المعتدل.