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COMPARATIVE STUDY BETWEEN THE EYEBALL IN THE CAT AND HENS (HISTOLOGICAL INVESTIGATION)

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ABSTRACT

Four specimens of eyeball of adult hens and cats were used in this study. They were put in formalin 10 % for fixation after anatomical dissection of the head. After 24 hour of fixation, the whole specimens were processed for histological examination. The retina and cornea of both animals were examined under light microscope. In the hens and cats the eyeball was formed of three similar layers, sclera, choroid and retina, but in hens the sclera showed the presence of hyaline cartilage instead of collagen fibers. The choroid of cat was taller and more folded then in hens. The retina of hens showed the presence of rods more than in hens which reflect the ability of cat to recognize the objects in Dim light gradient then hens.

Key word: Histology, Hens, Cats, Retina

INTRODUCTION

The eye ball is a highly sensitive structure in the body (Banks, 1986). Its importance lies in receiving the light in both day and night and descending it on the retina which is the have structure associated with cones, bipolar and ganglionic neurons (Moses, 1974). So are very important to convey the signals of vision to the brain via optic nerve to translate it into photography in the primary visual area in occipital lobe of brain (Cioffi and Sullivan, 1999). The eye is a sensory organ designed for vision. Basically it is composed of three layers or tunics: an outer fibrous tunic (scleral), middle vascular tunic (or choroid) and an inner retinal tunic. The fibrous tunic is divided in to the posterior, opaque sclera and the anterior, transparent cornea. The vascular tunic includes the choroid ciliary body and iris. The retinal tunic consists of a ten-layered, photosensitive retina and bi-layered, non- photosensitive portion that cover the ciliary body and the posterior surface of the iris (William and Flach, 2003). The eye of birds most closely resembles that of the reptiles. Also, unlike the mammalian eye the sclera of the eye consists of densely inter woven bundles of collagenous fibers arranged parallel to the surface of the wall of eye.

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The cornea is non-vascular and its anterior (outer) surface is covered by the non-keratinized stratified squamous epithelium. The choroid: is the portion of vascular tunic of the eye that lies between the sclera and the photosensitive retina. The ciliary body: is an anterior continuation of the choroid that extend to the base of the iris. The iris: is the most anterior part of the uveal tract. It forms a thin contractile diaphragm with the central aperture, the pupil. The retina: is the inner most layer of the wall of the eye. The conjunctiva: is thin transparent mucosa membrane. The eyelids: are covered internally by the palpebral conjunctiva and externally by thin skin. The nictitating membrane (third eyelid): is aventromedial fold of conjunctiva, it is supported by elastic cartilage in the cat. The lacrimal gland: is atubuloacinar gland, serous in the cat and mixed in the horse, ruminants and dog (Bloom, and Fawcett, 1976). The eye of the hens is quite different from that of mammals within the capsule the lens is divided into the annular pad and the lens body. The annular pad forms as outer ring around the equator of the lens body. It consist of radially arranged lens fibers with peripheral nuclei. In the lens body the lens fibers are oriented parallel to the optical axis of the eye and some nuclei are present primarily near the annular pad (Dellmann and Brown, 1994). Is the presence of the ring of over lapping sclera ossicles, anteriorly and a cup shaped layer of hyaline cartilage. The sclera cartilage posteriorly (Lucas and Stettenheim, 1972) the choroid is a thick vascularized coat with numerous pigment cells. The ciliary body is that layer of loose connective tissue

with thick outer region of numerous elastic fibers. The iris is thickest layer, its narrow base then tapers toward the pupillary margin. The iris is a colored muscularly operated diaphragm in front of the lens which controls the amount of light entering the eye (White *et al.,* 2007). The photo sensitive retina of the chicken: is composed of 10 layer as in other mammals, but unlike that in mammals is avascular. The pectin is that, highly vascular pleated membrane that protrudes into the cavity of the vitreous humor from the ventral surface of the eye. The filtration angle of the chicken is somewhat different from that of mammals. The chicken has a thin wall developed nictitating membrane, supportive cartilage is absent. The lacrimal gland is a small Tubular gland that produces a mucous secretion. It lies medial to the caudal part of the lower eyelid (White *et al.,* 2007; Sivak, 2004). Is the transparent anterior fifth of the fibrous tunic of the globe. The function of the cornea include support of intraocular content refraction of light (because of its curvature) and transmission of light (because of its transparency). Like the lens the cornea is normally clear avascular and refracts light (40-42 diopters). The cornea relies both aqueous humor and tear for nourishment and cleansing and on the eyelids and membrane nictitans for protection from the external environment (White *et al.,* 2007). The corneal thickness is not uniform being thinnest along the nasal superior quadrant overall, the mean axial thickness (0.546mm-0.578mm) is essentially identical to the mean perilimbal thickness. The mean thickness does increase significantly with age up to 100 months (Sivak, 2004). An investigation into the collagenous structure of the mature avian cornea is presented. Wide-angle X-ray diffraction is employed to assess collagen organization in 9-month-old chicken corneas. The central 2-4mm corneal region features a preponderance of fibrils directed along the superior-inferior and nasal-temporal orthogonal meridians (Sivak, 2004). More peripherally the orientation of fibrils alters in favor of a predominantly tangential arrangement. The chicken cornea appears to be circumscribed by an annulus of fibrils that extends into the limbus. The natural arrangement of collagen in the chicken cornea is discussed in relation to corneal shape and the mechanical requirements of avian corneal accommodation. Equivalent data are also presented from age-matched blind chickens affected with the retinopathy, globe enlarged, mutation, characterized by an abnormally thick and flat cornea. The data indicate considerable realignment and redistribution of collagen lamellae in the peripheral cornea. In contrast to normal chickens, no obvious tangential collagen alignment was evident in the periphery of corneas. In mammals, the presence of a limbal fibril annulus is believed to be important in corneal shape preservation. We postulate that corneal flattening in chickens may be related to biomechanical changes brought about by an alteration in collagen arrangement at the corneal periphery (Wolsley *et al.,* 2008). The study was designed to compare between the histological structure of the retina in both hens and cat and demonstrate the ability of its different in vision inbetween in the dim light.

MATERIALS AND METHOD

Cats and hens were obtained from a local markets and these animals were local breed. One were sacrified immediately at one time.

1- Hens: by slaughtering
2- Cats were anaesthetized by intensive dose of chloroform and then killed samples of eye ball were taken by excisign the bones of the frontal and orbital bones lifting the eye of both sides of each animal by same manner and then the samples were washed with running water for (10) minutes to remove blood and other surrounding tissue damaged during the removal of an eye. Histological processing were done to obtain sections stained with haematoxylin and eosin for examining under light microscope (Luna, 1968). The following steps were applied to show the histological structure of eye ball

1- Fixation in with 10% formalin.
2- Dehydration with different stages of alcohol concentration.
3- Clearing in xylene, Infiltration, Embedded with paraffin, Sectioning at 6 µm thickness and staining, finally staining with (H&E).

RESULTS

In The Hens

The present study was demonstrated that the sclera in hens was formed by hyaline cartilage with chondrocytes and matrix covered by perichondrium.

Choroid vascular layer was containing many blood vessels, this layer was formed by short epithelial cells, like folds or cristae.

The retina was containing Pigmented cell which are melanocyte, present in the form of crests or papillae.

Rods and cones were demonstrated, rods were columnar tall cells and the cones were funnel – like shape and these cells more numerous than rods. (Fig.1).

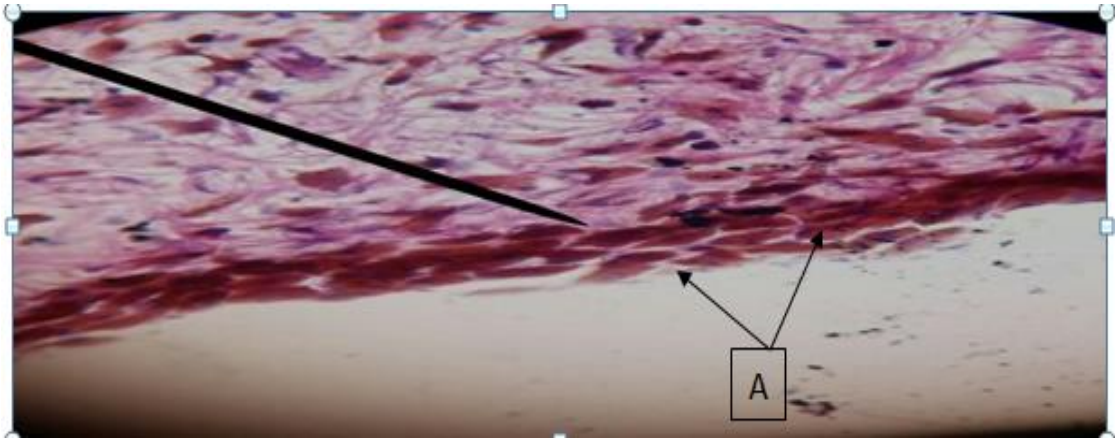

Fig. (1): Demonstrating the presence of cones and rods in the retina of hens (A) (H&E x 40)

The nuclei of cone cells were seen in different layers (syncytium like), nuclei. Other types of cells were also present in the outer plexi-form layer, such as bipolar, horizontal, a macrine and Muller's cells with its nuclei, other wise melanocytes were associated with ganglionic cell are present in the periphay. (Fig. 2).

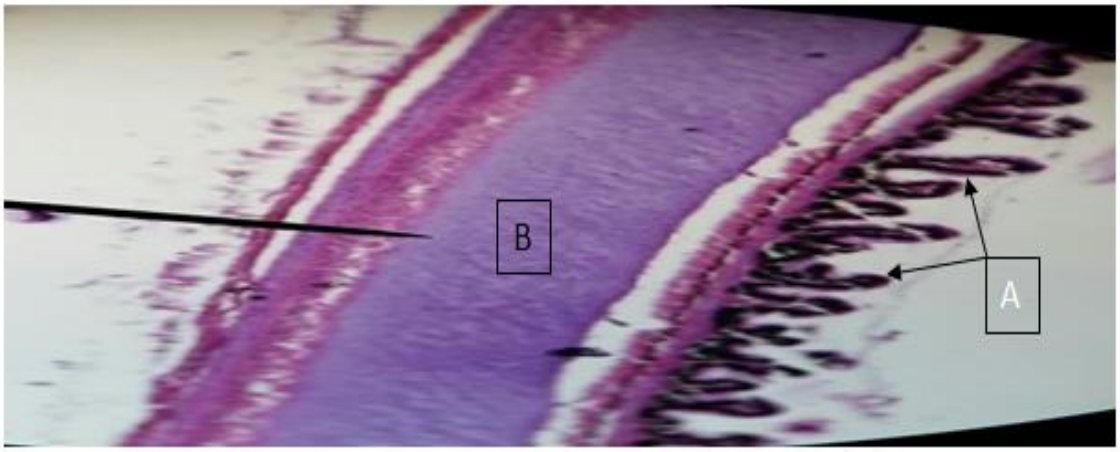

Fig. (2): Choroid (A) of eye ball of hens also showing the cartilage (B) of retina (H&E x 20).

In the Cat the sclera formed by a thick bundles of collagens fibers, in between there are large sized blood vessels. **Choroid** vascular layer formed by a great number of blood vessels of small size, in between there are a large number of collagen fiber in different directions with scattered melanocytes. (widen than chicken) also the choroid was formed by long, irregular cristae. (Fig. 3).

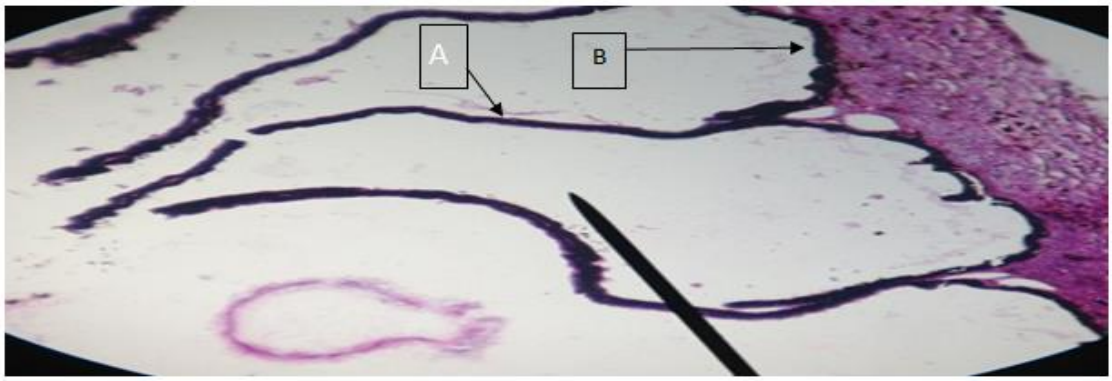

Fig. (3): Choroid is long (A) and retinal layer in cat (B) (H&E x4)

Pigment layer: is formed by great extensions of pigment cell (finger likeand this layer is highly intensive with melanocytes and in certain place appeared thread like (tortious – pattern). Rod and cons: The rods of cat was greater in number than the hens which appeared tall, stick- like cells with melanocytes (extensive) layer. Ganglionic cell layer (present periphery) to the retina with pyramidal cells.

DISCUSSION

The present study demonstrated that the composition of layers of the eye was prominent in chicken compared with the cats and this concept was in agreement with other authors such as (William and Flach, 2007; Kirk and Gelatt, 2007). The layers of the eye ball of the cat was corresponding to that in the hens involving the layers of the retina and this concept was in agreement (wolsley *et al.,* 2008). It was found that this study indicated that of rods in the eye of hens were fewer in number in comparison with these in cat which were numerous and this concept was in agreement with other study (Boote *et al.,* 2008, Lucas and peter, 1972). On other hand in present study the sclera of eye in hens may composed of hyaline cartilage disagreement with the study of (Sivak, 2004). The sensitivity of eye in the hens during the dim lighting was very weak, so resort chicken to sleep early night and for this reason this lead to decrease in the number of rods in the retina of eye ball in addition to the lack of pigmentation in the pigment cells and vitamin A, While the Sense appointed in cats at dim light in the night very high, largely due to the presence of greater numbers of rods and the element cobalt concentrations higher so it can be seen in the dark with the presence of dim light and this concept was in agreement with other author such as (Lucas, 1972). The presence of cobalt in the retina was very essential to react with other mineral elements in the retina which reflecting when light falling on them shall give luster eye during the dark and the prospect of Vitamin A consider as another factor for the ability to interact with the Rods cells to produce Rhodopsin which has the ability to scan overnight delivery and this concept was in agreement with other author such as (Gartner, 1987). People complaining from night blindness, show that deficiency of vitamin A is the main reason which reflect the need of rods to this vitamin A to sustain the vision and this concept was in agreement with other author such as (Mar *et al.,* 2009; Gene ser, 1989). In people with night blindness showed lack of the vitamin (A) and this phenomena indicate the role of this vitamin to help the rods cells of the retina to release the rhodopsin which sustain the vision and this concept agree with.

CONCLUSIONS

The present study was demonstrated that the histological structure of the eye ball and particularly the retina was differ in the cat and hens due to differences population of the rods which are very important for reception of the light in the dark night, so the rods in cat were numerous in comparison to that of hens which explain the better vision of cat in dim light in compare to that of hens. The sclera of hens was formed mainly by hyaline cartilage as a framework, while in the cat was formed by collagen bundles.

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دراسة مقارنة بين مقلة العين في القطة والدجاج (استقصاء نسيجي)

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استخدمت في هذه الدراسة أربعة عينات من مقلة العين للدجاج والقطط البالغة. تم وضع هذه العينات في الفورمالين ١٠ ٪ للتثبيت بعد تقطيع الرأس تشريحيا. بعد ٢٤ ساعة تم تجهيز العينات كلها للفحص النسيجي. تم فحص شبكية العين والقرنية لكلا الحيوانين تحت المجهر الضوئي مع أجزاء أخرى للعين. تتكون مقلة العين في الدجاج والقطط من ثلاث طبقات ، الصلبة ، المشيمية والشبكية ، ولكن أضهرت النتائج في الدجاج وجود الغضروف الزجاجي في الصلبة بدلاً من ألياف الكولاجين. كانت مشيمية العين في القطط أطول واكثر تفرعاً مما كانت عليه في الدجاج. أظهرت شبكية القطط أن العصي كان محميًا أكثر من الدجاج مما يعكس قدرة القط على التعرف على الأشياء الموجودة في التدرج الخافت للضوء بالمقارنة مع الدجاج.

الكلمات الافتتاحية: علم الأنسجة ، الدجاج ، القطط ، شبكية العين.