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# بعض الدراسات الهستومورفولوجيه على عضلات العين فى الكلب

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تم دراسة بعض الصفات المورفولوجيه والهستولوجيه فى عضلات العين وقد وجد انها تختلف عن بعضها البعض فى التركيب الهستولوجى ، وكذلك حجم الحزم العضلية ،وقورنت بمثيلتها فى الحيوانات الأخرى والانسان .

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# SOME HISTOLOGICAL AND MORPHOMETRICAL STUDIES OF THE EXTRAOCULAR MUSCLES IN DOG
(WITH 2 TABLES & 9 FIGURES)

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## SUMMARY

The study of the histomorphological features of the extrabocular muscles in the dog showed that, the thickness, length, of their muscle bundles as well as the histomorphological features of these muscles is not the same, also the C.T. capsule and C.T. septa within the muscle.

## INTRODUCTION

Many anatomical and histological features of the extrinsic muscles of the eyeball are of great importance. The literature on the histological and biometrical studies of the extraocular muscles in the dog is meagre. Many authors studied the histological and the fiber size distribution of different muscles of the animal skeletal muscles (EDGERTION and SIMPSON, 1969 PETROV, 1976 and GONYEA, 1979). Others studied the distribution of fiber types in the extraocular muscles of man ( WOLLARD, 1931 ) and cat ( NAG and PEACHEY, 1972 ). The aim of the present study is to throw light on the histology of the extraocular muscles in dog. Moreover, some morphometrical studies were performed on these muscles.

## MATERIAL AND METHODS

Five adult dogs of different age and sex were used in the present study. The eyeballs of the experimental animals were exenterated from the orbital cavity after euthanization of the animals. The extraocular muscles, namely the dorsal rectus (DR), ventral rectus (VR), medial rectus (MR), lateral rectus (LR), dorsal oblique (DO), ventral oblique (VO) and retractor bulbi (RB), were dissected bluntly and subjected to an anatomical study including the length, thickness and the length of tendinous insertion. Small pieces were taken from the central portion of each muscle and fixed in 10% formalin for 24 hours.

The muscles were prepared for histological and morphometrical studies by paraffin technique, and cutting transverse serial sections at 5-8 um. The sections were stained with haematoxylin and eosin, Masson's trichrome, Van Gieson's, Weigert's elastic and periodic acid Schiff technique. Some histological features of the muscles were observed as regards to the C.T. capsule, the number of the muscle bundles in each muscle, the number of the muscle fibers in each bundle, the precentage of each type of the muscle fiber and the diameter of the muscle fibers. Muscle fiber diameters were measured by using a micrometer eye piece and thus typed for one of the three. Moreover the number of the muscle fibers was calculated.

## RESULTS AND DISCUSSION

The length, thickness and the length tendinous insertion of the extraocular muscle of the eyeball of the dog are illastrated in Table (1).

TABLE 1 (in cm)

| Muscle | Length | Thickness | Length of tendionus insertion |
|---|---|---|---|
| D.R. | 3.5 | 1.0 | 0.46 |
| V.R | 3.4 | 0.9 | 0.35 |
| M.R. | 3.2 | 0.9 | 0.54 |
| L.R. | 3.9 | 0.97 | 0.58 |
| D.O. | 3.1 | 0.5 | 1.01 |
| V.O. | 3.6 | 0.6 | 1.30 |
| R.B. | 3.4 | 0.4 | 0.40 |

The masses of fibers, that make up the different types of muscle, are not grouped in random fashion, but are arranged in regular bundle s urrounded by a thick external donse connective tissue capsule, surrounding the entire muscle (Fig. 1).

From this capsule connective tissue septa extend inward and surround the bundles of fibers within a muscle. These septa are extremely rich in elastic fibers. The latter observetion corresponds with that given by SCHIEFFERDECKER (1904). He stated, that the elastic fibers in the superior rectus muscle is very thick. Each muscle fiber is surrounded by a network of reticular fibers.The thick external connective tissue capsule consists mainly of collagenous and elastic fibers and contains fibroblasts, blood vessels and nerves.

The (MR) muscle has the largest number of muscle bundles compared to any the extraocular muscles, while the (RB) has the smallest number. This result can be clearified by the fact that the (RB) muscle is contractile the number of bundles constituting its bluk incomparison to the other extraocular muscles of the eyeball. The (DO) muscle and the (DR) muscle have about the same number of muscle bundles. Also the (VO) muscle has a similar number of bundles as the (LR) bundles.

A muscle bundle varies in diameter according to the number of muscle fibers it contians. The largest diameter is found in bundles which contain thick and intermediate sized fibers and are located in the center of the muscle, while the smallest diameter bundles which contain thin sized fibers, occur in the periphery of the muscle. The number of muscle fibers in each bundle of extraocular muscle ranged from eight in small bundles to 83 muscle fibers in large bundles. WOOLARD (1931) found that the thickest fibers tend to occur in bundles of 10-15.

The avarage number of muscle fibers ranged from 30 to 50 (Table 2). The ( MR ) muscle has the greatest number, while the (DO) and (DR) have the minor number. The skeletal muscle fibers are classified by EDGERTON ET AL., (1969); YELLIN ET AL., (1970) TITTEL, (1974); MARTIN (1979) and CONYEA (1979), into three types, and by NAG (1972), PETROV (1976), into red and white fibers.

As shown in (Fig. 3) the muscle fibers are differentiated into red, white and intermediate. Table (2) shows that the white muscle fibers predominate. They reach to 89% in (RB) muscle and 78% in (MR) muscle. The red muscle fibers are fewer in number, reaching to 9% in (MR) muscle and 3% in (RB) muscle. The intermediate muscle fibers are in intermediate position between the white and red. Great number are demonstrated in (MR) muscle (13%). Small numbers occur in (RB) muscle (8%). The red muscle fibers have a very regular circular shape with a very distinct sarcolemma (Fig.4). It is located in the bundle an irregular manner.Some are found in the core and others in the periphery of the bundles (Fig. 5,6). The red muscle fibers are surrounded by numerous blood vessels and nerves (Fig.7). The diameter of the musole fiber ranges from 8-60um with an average of 25.8 um. In man WOOLLARD, (1931) stated that the diameter of the thickest muscle fiber being two to three times that of the thinnest one. In dog our observations indicate, that the diameter of the thickest fibers is about 10 times that of the thinnest. We can calssify the muscle fibers as follows: thick - sized muscle fibers, mediumsized muscle fibers and thin - sized mucle fibers. The thin - sized muscle fibers occur usually in the periphery of the muscle and increase gradually in size towards the center of the muscle bundles. On the other hand,the center of the muscle bundle contains medium-sized and thick - sized muscle fibers. Between or around the thin white muscle fibers in the periphery are found thick or medium sized red muscle fibers.The red muscle fibers in each ocular muscle have the largest diameter, which range from 15-60 um with an average of 29.9 um. while the white muscle fibers ranged from 8 - 60 um with an average of 22.2 um. The intermediate muscle fibers have a diameter ranged from 12 - 40 um with an average of 23.9 um.

The thin fibers are mostly located towards the peripheral part of the muscles, while in the center of the muscle belly, the fibers are much thicker. The most numerous fibers were the medium size muscle fibers which comprise the greater part of the muscle belly. This results like that observed by DAVSON (1962) in man.

TABLE (2)

| Muscle | Number | | Red fiber/ | Intermediate/ fiber | White fiber/ |
|---|---|---|---|---|---|
| | Bundle | Fiber | % | % | % |
| DR | 450 | 10 - 53<br>50 | 3 | 10 | 87 |
| VR | 500 | 12 - 70<br>39 | 8 | 12 | 80 |
| MR | 600 | 10 - 72<br>50 | 9 | 13 | 78 |
| LR | 360 | 9 - 83<br>40 | 4 | 10 | 86 |
| DO | 430 | 9 - 68<br>30 | 4 | 10 | 86 |
| VO | 340 | 17 - 59<br>31.7 | 6 | 11 | 81 |
| RB | 197 | 11 - 54<br>39.2 | 3 | 8 | 89 |

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Fig. 1: V.R. from the peripheral of muscle.
Stain: trichrome.
ob. 20 oc. 5: 1k

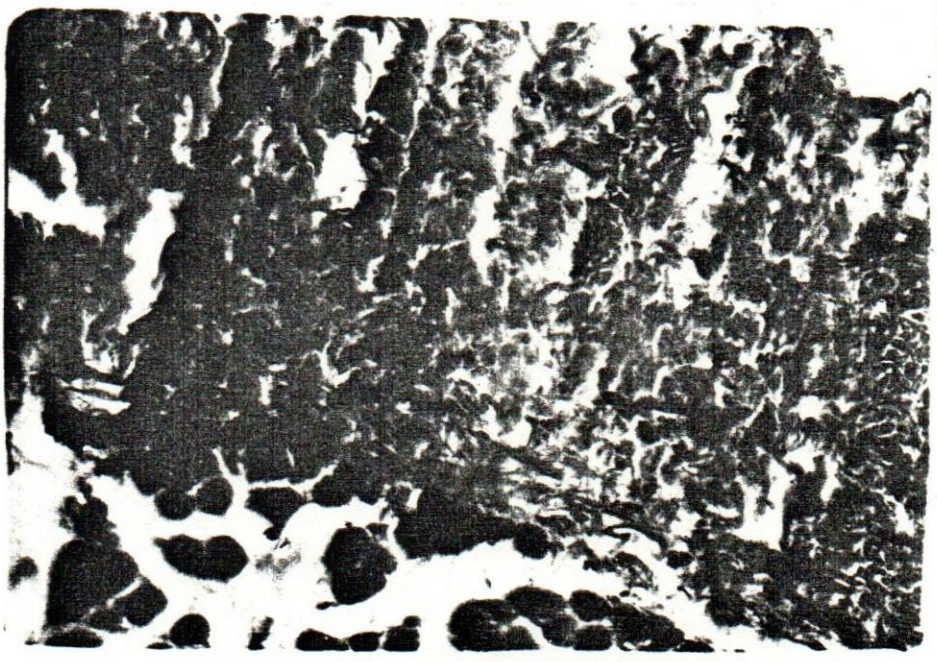

Fig. 2: V.O. C.T. capsule.
Stain: trichrome.
ob. 20 oc. 5 : 1k

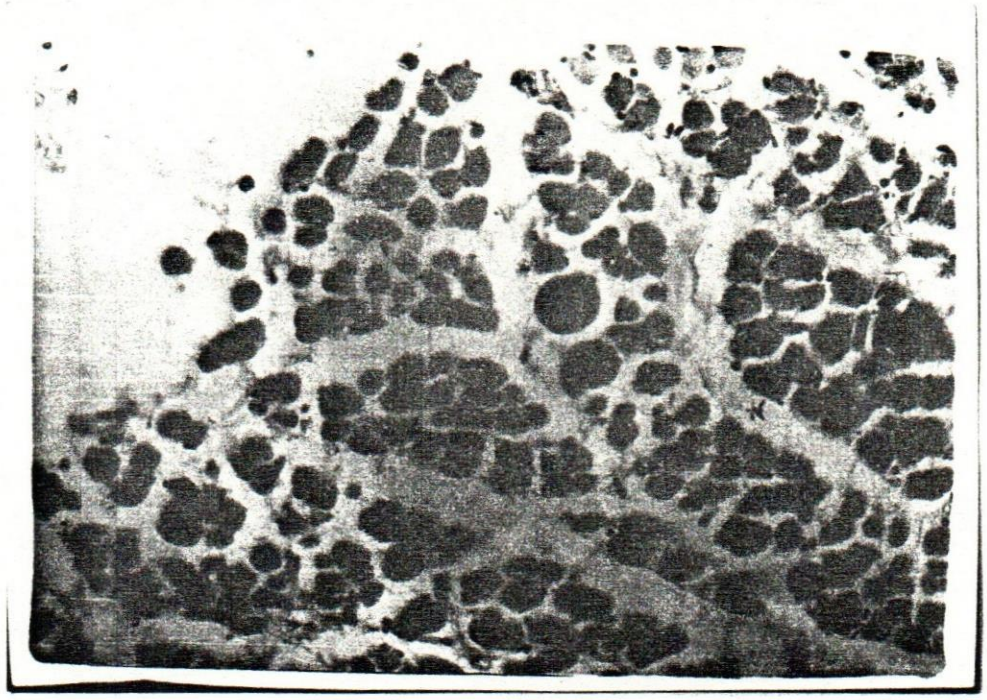

Fig. 3: M.R.
Stain: H & E.
ob. 20 oc.: 5 : 1k.

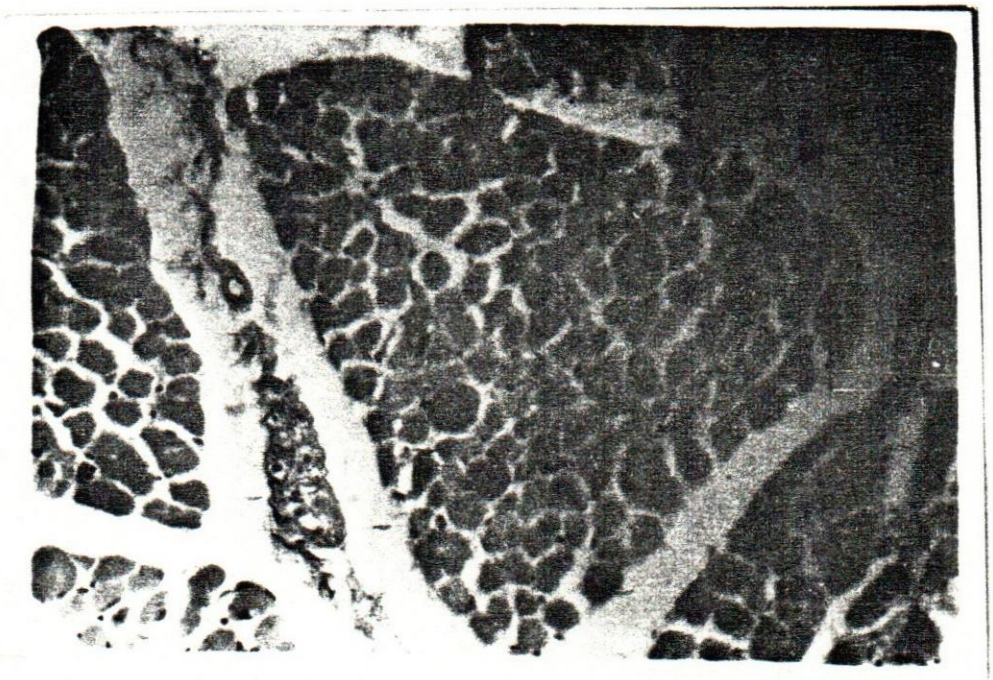

Fig. 4: D.R.
Stain: trichrome.
ob. 20. oc.: 5 : 1k

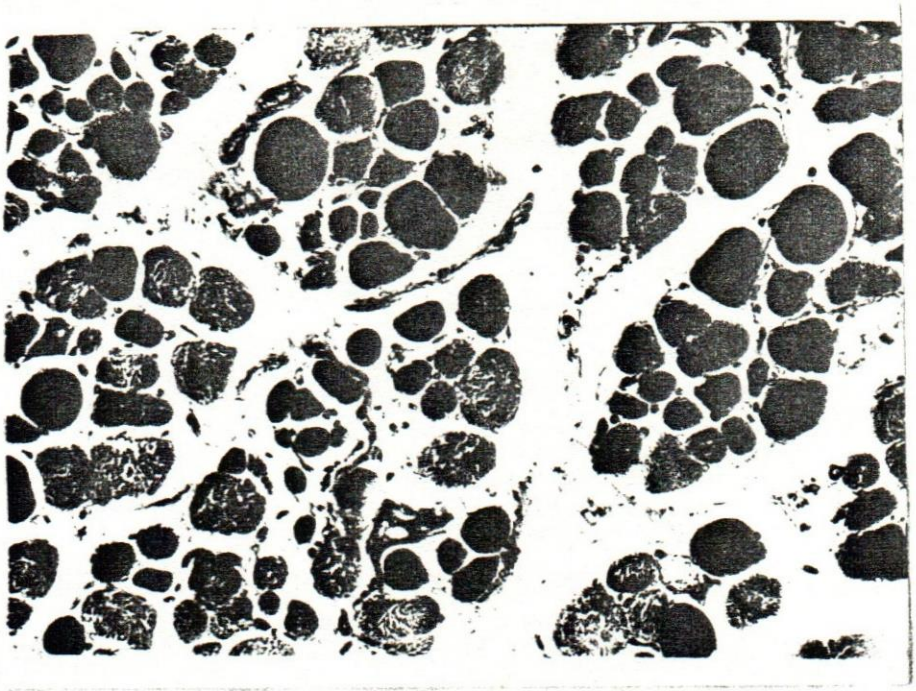

Fig. 5: V.R.
Stain: trichrome.
ob. 20. oc. 5 : 1K

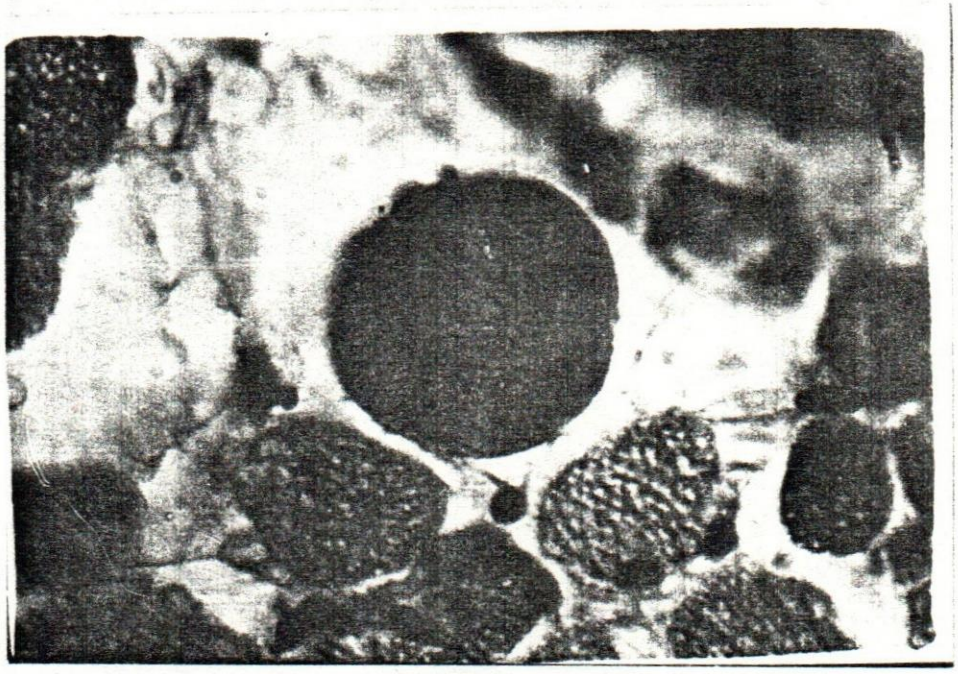

Fig. 6: D.O.
Stain: H & E.
ob. 100. oc. 5 : 1K

Fig. 7: V.R.

Stain: trichrome.

ob: 40. oc. 5 : 1k

Fig. 8: M.R.

Stain: trichrome.

ob. 20 oc. 5 : 1k

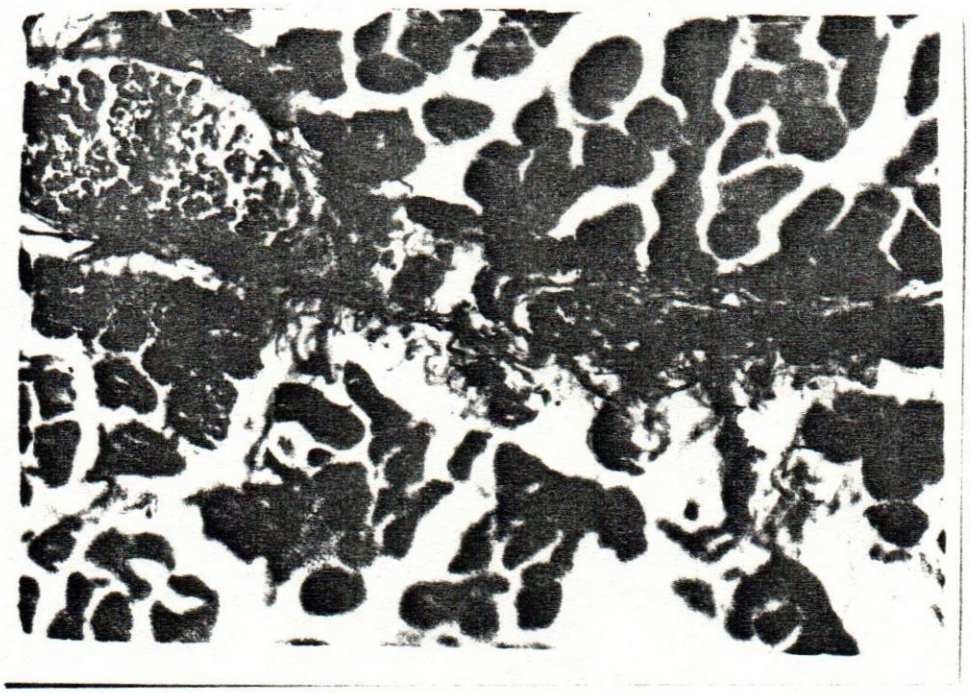

Fig. 9: V.O.

Stain: trichrome.

ob. 20. oc. 5 : 1K