STUDY OF THE ROLE OF COPPER, ZINC, ERYTHROCYTE SUPEROXIDE DISMUTASE AND CATALASE IN RETINITIS PIGMENTOSA

Thesis

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By

HAGER EMAM MOHAMED AHMED

Asst. Research - Biochemistry Department
Research Institute of Ophthalmology
Under Supervision

OF

Prof. Dr. Mohamed Mohamed Abd-El-Fattah
Professor of Biochemistry
Faculty of Science
Ain-Shams University

Prof. Dr. Fawzi Amin El-Shobaki
Professor of Biochemistry
National Research Center

Prof. Dr. Magdoline Yahya El-Gammal
Professor of Ophthalmology
Research Institute of
Opthalmology

Dr. Nabil Abd-El-Kader Saleh
Lecturer of Biochemistry
Faculty of Science
Ain-Shams University

Faculty of Science
Ain Shams University

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بسم الله الرحمن الرحيم

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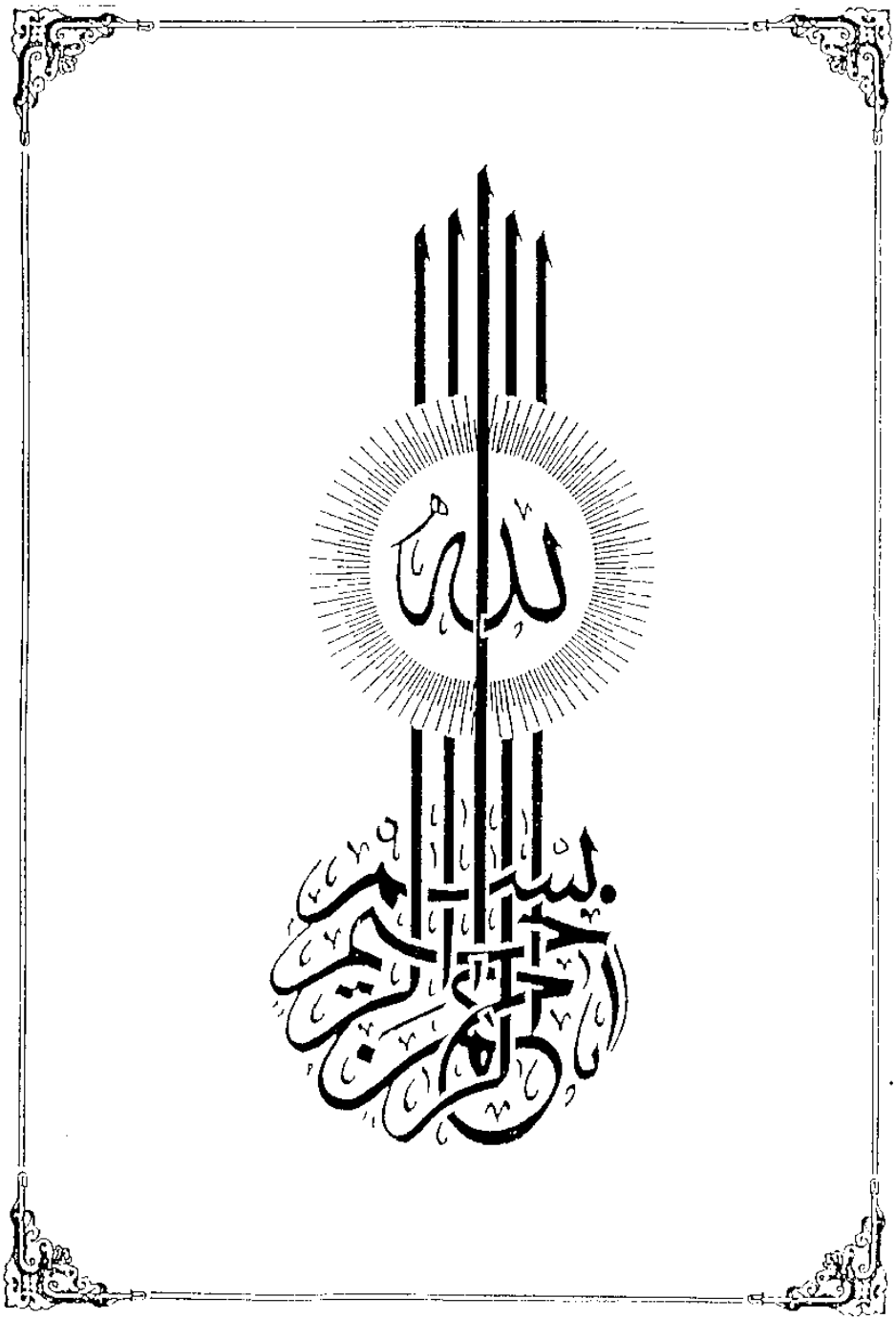

TO MY MOTHER, MY HUSBAND AND MY CHILDREN

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INTRODUCTION

Retinitis pigmentosa is a set of hereditary disorders that diffusely and primarily affect photoreceptor and pigment epithelial function (John, 1988). This disease may progress to loss of visual field and eventually blindness. The retinitis pigmentosa process is found worldwide at an estimated prevalence of about 1:4000 to 1:7500 (Bunker et al., 1984).

Several studies have considered the relationship between abnormalities in serum copper levels and retinitis pigmentosa. However, conflicting data are coming out from different localities. Marceau and Aspin (1973) reported abnormality in serum levels of both copper and zinc in patients with retinitis pigmentosa. Gahlot et al. (1976) reported that serum copper level was within normal. In contrast, Rao et.al.,(1981) reported an elevated level of serum copper in a series of 24 patients with decreased ceruloplasmin levels. These results in general, imply an abnormal copper metabolism in retinitis pigmentosa. Copper and zinc are known to be important co-factors for the free radical scavenging enzymes superoxide dismutase and catalase (Hassan, 1988; Kernell et al., 1992). It appears that a close correlation between each of copper, zinc and the activities of these enzymes. In turn it is believed that free radical can be a factor contributing to the incidence of the retinitis pigmentosa among different individuals. Only one single article was found dealing with the change in superoxide dismutase activity in patients suffering from retinitis pigmentosa (Rosalie and Jerre 1982). They reported a normal level of erythrocyte superoxide dismutase, copper and zinc in retinitis pigmentosa. These findings did not agree with other reported abnormalities in zinc and copper. Thus, the interference of varying etiological factors in the pathogenesis of retinitis pigmentosa still exists.

The aim of the present study is to evaluate the possible changes in the activities of free radical scavenging enzymes and levels of serum copper, zinc, ceruloplasmin, vitamin E and total protein in Egyptian patients with retinitis pigmentosa.

The study also includes a comparison between changes that occur in these parameters in humans suffering from retinitis pigmentosa and that which occur in either rats or rabbits exposed to ultraviolet source.

A group of patients suffering from diabetic retinopathy was also included for comparative purposes.

LITERATURE REVIEW

The Retina

The retina is a multilayered sheet of neural tissue closely applied to a single layer of pigmented epithelial cells, attached to Bruch's membrane (Fig. 1). It is most thin at the fovea centralis, the center of the macula. The retina is normally transparent, and some of the incident light is reflected at the vitreo retinal interface (Daniel and Taylor, 1980).

It is composed of highly organized delicate tissue consisting of 9-histologic layers. The fovea centralis, which lies about 3.5 mm lateral to the optic disk, is specialized for fine visual discrimination. In the fovea, the receptors are all cones. The outer nuclear layer is thinned. The other paranchymal layers are displaced centrifugally, and the internal limiting membrane is thin. Throughout most of the retina, the axons of the receptor cells pass directly to the inner side of the outer plexiform layer where they connect with dendrites of horizontal and bipolar cells, which extend out ward from the inner nuclear layer. In the macula, however, the receptor cell axons follow an oblique course and are called the Henle fiber layer (Daniel and Taylor, 1980).

The axons of the bipolar cells are connected with a macrine and ganglion cells in the densely woven inner plexiform layer. The long axons of the ganglion cells pass in the nerve fiber layer to the optic nerve.

The retina receives its blood supply from two sources. The choriocapillaris is a single layer of closely spaced capillaries intimately attached to the outer surface of Bruch's membrane. The choriocapillaris supplies the outer third of the retina including the outer plexiform and outer nuclear layers, the photoreceptors, and the pigment epithelium.

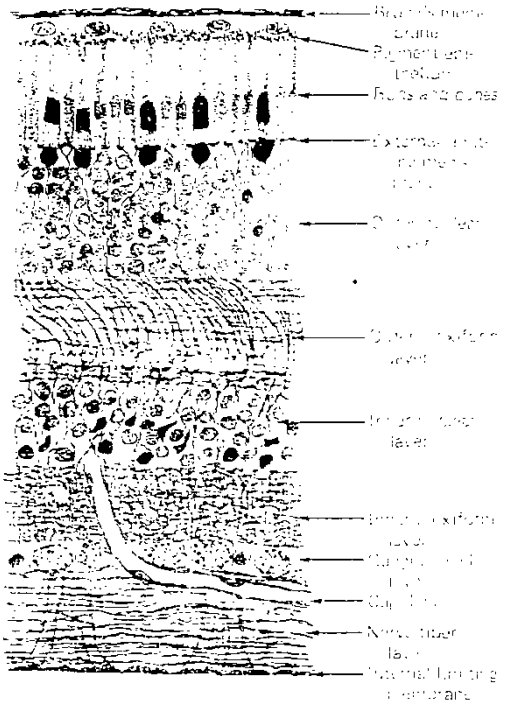

Figure 1: Layers of the retina (Redrawn and reproduced, with permission, from Wolff: Anatomy of the Eye and Orbit, 4th ed. Blakiston-McGraw, 1954)