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Antioxidants prevention of diabetic damage in the organ culture bovine lenses

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Investigation of the mechanisms of cataract formation under diabetic conditions, and examination of the effects of N-acetyl-L-cysteine(NAC), (which is a precursor of glutathione and an anti-inflammatory agent) Desferrioxamine (DFO) and Lutein on diabetic cataract. The function of the eye lens is to focus light on the retina and consequently the lens must remain transparent throughout life. Cataracts (loss of lens transparency) are a major cause of blindness in the aging population. Despite the amount of research done, the mechanisms of cataract formation are still not completely understood.

Bovine lenses were exposed in organ culture to 450 mg % glucose, which simulates acute diabetes. Other lenses were exposed to 450 mg% glucose including antioxidants: Lutein, DFO or NAC. Control lenses were incubated without glucose or antioxidants. Other controls were incubated with each antioxidant without glucose. Incubation time was 15 days. Lens optical quality was assessed throughout the 15 days of the culture using our unique laser system. At the end of the culture period, lenses were analyzed by inverted microscopy and the lens epithelial layer was used for histochemical analysis localization of hexokinase activity. Reactive Oxygen Species (ROS) was discovered by flow of epithelial cells lens labeled with 5-(and 6-)chloromethyl-2',7'-dichlorodihydrofluorescein diacetate, acetyl ester (CM-H2DCFDA, C6827) to measure the component level of cellular oxidation in the cells of lens epithelium. Lens proteins were analyzed by SDS gel electrophoresis.

High levels of glucose in the culture medium caused optical and morphological damage to bovine lenses. Antioxidants reduced the damage caused by high glucose levels. The activities of the enzyme hexokinase were increased significantly in the presence of glucose. Dark blue formazan granules indicate sites of high activity of hexokinase. Formation of ROS in the epithelium was monitored and detected, by fluorescence, in intact bovine epithelial cells layers, from the different treatment groups. Lenses incubated in high glucose in the presence of NAC show the same soluble protein profile as the controls.

High glucose in the culture medium causes damage to bovine lenses. Antioxidants protect the lens from high glucose (diabetic) damage. Antioxidants reduced the damage to cells shape and prevent the increased activity of hexokinase, ROS and proteins. NAC protected the lenses from high glucose damage better than Lutein and DFO. We suggested that NAC can serve as an effective protector for the eye lens against diabetes damage

Biography

Bormusov Elvira in 1986 has protected theses for Ph.D. degree in biological sciences in the Moscow Helmholz Research Institute of Eye Diseases Conferred on a university degree of Ph.D. in Biological Sciences (Pathologic Physiology,Embryology and Histology). Research work application of low frequency US with ENKAD in toxic injuries of rabbit eye tissues, studies of its influence upon metabolic indices of cornea and epithelium lens of animals of different age. Working Odessa Medical Institute, Central Scientifc and Research Laboratory. In the 1987 Senior Research Fellow at the Laboratory of Industrial and Ecologic Toxicology. Toxicometric investigations (physiological tests, biochemical methods, allergen and neurotoxic activity) in studies of hygienic regulations of paint and varnish applied at transport and influence of their separate components upon white rats organisms.

2002-present Senior Scientist, Faculty of Medicine, Technion, Haifa, Israel. Study Influence of high-frequency microwave electromagnetic radiation (mobile phone) on epithelium lenses and protection by antioxidants, high oxygen load and heat, diabetes exposure related damage on bovine lens (in vitro). Published: 94 publications. Published in Israel: 10 articles published in professional magazines and 24 at conferences in the various countries.