EFFECTS ON FRUCTOSE OF RADIATION INDUCED LENTICULAR OPACITY

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ABSTRACT—The purpose behind the study of radiation induced lenticular opacity was to know the distribution of the lens Fructose and their interaction with environmental radiation coming from the sun. Fructose is the important hexose sugar in the lens. It plays an important role in energy metabolism. In the lens the biological energy is necessary for the maintenance of transparency, synthesis and repair process (Kuck, 1965). This study provides information on the potential risk of cataract development due to exposure of Non-ionizing radiation i.e. UV-radiationduring their occupational activities. The entire study is carried out in two phases. Phase I the normal lenses from mice have been analyzed by the standardized method in the laboratory. The biochemical analysis was carried out. Phase II the observations obtained in the laboratory were correlated with the data of normal and different cataractous lenses of other groups. These data were outcome of the standardized methodology and exposure set up for irradiation in vivo and in vitro. Animals used for these studies were the mice (Musmusculus) and the rat (Rattusnorvegiicus) of either sex. The Control animals as well as the Experiment animals were kept in laboratory condition. They were fed with standard animal food and water (Phase I-II). The experiment animals were kept in radiation chambers periodically to see the effect of radiation on their lenses. Each lens from control and experiment strains was subjected to biochemical analysis. The irradiation of the lens by the non-ionizing radiation was carried out by the in vivo and in vitro method.

Keywords—Lenticular opacity, cataractous lens

INTRODUCTION

The normal mice lenses were round and soft with prominent convex posterior pole. It is located between anterior aqueous and posterior vitreous humour. It is a semi-solid, elastic, avascular highly organized cellular organ with smooth, shiny surface. The lens capsule was observed to be thinner at the posterior pole. The lenses show a non-cellular capsule layer consisting of two portions. The capsule appeared homogeneous in section, suggesting that the non-cellular capsule layer uniformly surrounds the lens fibers. The cortical lens fibers lens fibers were generally flattened and uniformly hexagonal in transverse section and elongated belt like cells. The nuclear fibers were highly compact and closely packed.

MATERIALS AND METHOD:

ESTIMATION OF FRUCTOSE

The amount of fructose content in the lens (in vitro and in vivo) of UV-exposed and control animals were estimated using the method of Foreman et al. (1973).

PRINCIPLE:

When the fructose of the homogenate is heated with 30% HCl, it is converted to oxy-methyl furfural which gives a red color complex with the resorcinol solution. The intensity of the color is proportional to the concentration.

OBSERVATION:

Fructose levels in the lens of UV irradiated cultured rat lenses and their controls at different duration of exposure are shown in the given Table I. fructose level in control lens were found to increase with advancing age. In the later stages the fructose levels in UV-exposed eye lenses in the in vitro experiments were found. The results indicate alterations in the carbohydrate metabolism in the crystalline lens brought by UV-radiation, associated with progressive lenticular changes.

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TABLE. I. LEVEL OF FRUCTOSE IN UV-INDUCED CATARACTOUS LENS

PARAMETER	EXPERIMENTAL TIME/ AGE (IN WEEKS)					
	7/11		15/19		25/29	
	CONTROL	TREATED	CONTROL	TREATED	CONTROL	TREATED
Fructose (μg/mg wet wt)	0.539 ± 0.01 (6)	0.554 ± 0.008 (6)	0.562 ± 0.013 (7)	0.587 ± 0.011 (7), A	0.617 ± 0.008 (7)	0.653 ± 0.008 (7), D

(Values are Mean ± S.E. Numbers in parentheses indicates sample size, p-values: A: <0.2, D: <0.01)

DISCUSSION:

The results obtained from the investigation shows that in the UV-exposed lenses There was slightly significant increase of fructose level in in vivo while highly significant increase in cultured UV irradiated lenses. Associated with the progression of UV induced lens opacity, considerable change in the maintenance of lens sugar level was obtained. A considerable increase ($p<0.01$ to $p<0.001$) in the content of fructose was noted in the progressive UV induced opacity (in vivo and in vitro) fructose accumulates at increasingly higher levels (Kuck, 1965) because it does not penetrate the lens as easily as glucose.

SUMMARY:

From the data studied it could be concluded that long-term, low-level radiation exposure has salient effects on the crystalline lens, which enhances cataractogenesis. The biochemical change for the different duration of UV-exposure includes increase in Fructose. The study suggests that radiation causes a permanent lenticular damage which leads to irreversible lens opacity and support the concept that being in closed cavity lens has no repair mechanism for damage caused by radiation.

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