PREVENTIVE ROLE OF AQUEOUS HUMOR AS A POSSIBLE ANTICATARACTOUS NATURAL OCCULAR FLUID

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ABSTRACT
The formation of aqueous humour is a complex phenomenon involving movement of ions between blood vessels of the eyes and intra ocular fluids. The AQH serves as a sole nutrient medium and also determine the intra ocular pressure. The intra-ocular pressure depends primarily on the rate of secretion of AQH. The value of TSH content being highest in the age group of 31-40 years and lowest in the age group of 41-50 years. The average value of TSH content of AQH of normal human eye is 3.34 uM per 100ml. The decrease of ascorbic acid concentration is 31.38% in the last age group (81-90Yeras) when compared to first age group (31-40 Years). The potential significance of the reaction of photooxidized aromatic compounds with proteins in the mechanism of cataract formation.

Key words: aqueous humour (AQH), Human eye, Ascorbic acie, Total sulfidryls,

INTRODUCTION
The aqueous humor is a term which has been anatomical and a physiological connotation. In its real term aqueous humour is the fluid found in the anterior chamber of the eye. The viscosity of the normal aqueous humour is little greater than water but less than blood. The pH value for plasma, aqueous humour and vitreous humour are as 7.4, 7.6 and 7.57 respectively.

The formation of aqueous humour is a complex phenomenon involving movement of ions between blood vessels of the eyes and intra ocular fluids across a number of different barriers, each having individual physical and chemical properties. must be given the credit for establishing beyond reasonable doubt that the aqueous humour is continuously formed and drained away.
Since none of the membranes, which covers the anterior and posterior chamber, is completely impermeable to naturally occurring substances, it is clear that these substances could enter the aqueous humour from any of the surrounding tissues the ciliary processes, the lens, the iris, the cornea and the vitreous. Similarly any substance could leave the aqueous humour and pass into any of these tissues.

The AQH serves as a sole nutrient medium and also determine the intra ocular pressure. The intra-ocular pressure depends primarily on the rate of secretion of AQH, so the factors influencing these are of vital importance in understanding the physiology of the intra ocular pressure. Because of this reason, the chemistry of the fluid and the dynamics of exchange between if and blood should be considered primarily. The intra-ocular pressure also depends on drainage of AQH.

The AQH is called secretion. It implies essentially that it should be formed from the plasma (blood), something more than a mechanical filtration process that “skims” off the proteins. The cells of the ciliary epithelium must perform work – what is called osmotic work – in order to produce a fluid like aqueous humor, which is not only different from plasma but also from a filtrate of plasma or dialysate. In making the selection of secretion certain ions and molecules may be transferred across the cells to give higher concentrations in the secretion than in the original plasma filtrate, e.g. bicarbonate and ascorbate, whilst others transfer at lower concentrations, e.g. Calcium, urea etc.

The ascorbic acid content of the intra ocular fluid has excited great interest because its concentration is uniquely high in many species. The high ascorbate concentration in the AQH was shown by ocular biochemist [8]. The hypothesis that the ciliary epithelial cells actively transport ascorbate into the eye is supported by several consistent pieces of evidence. A
similar increase in the concentration of ascorbic in the aqueous can be induced by increasing the rate of blood flow through the ciliary body.

It is suggested by the observation that, at physiological concentration, ascorbic acid inhibits (about 25%) the darkening of the lens from exposure to near UV light\textsuperscript{[5]}. Ascorbic acid can effectively scavenge O\textsubscript{2} – radical\textsuperscript{[2]}, since dehydro ascorbic acid can be reduced by glutathione. It seems possible that ascorbic acid, GSH, NAD (P) H\textsubscript{2} could form part of a protective system such as that out lined above.

Evidence for the existence of such a system must await further experimental studies.

**MATERIALS AND METHODS**

Eyes were anaesthetized by giving local anesthesia, sterilized and cleaned properly. With fully dialated pupile and AQH of catarctous human eyes were obtained during the extra capsular cataract surgery done in operation theatre at Nagari Eye Hospital, Ahmedabad by experienced ophthalmic surgeons. The lenses thus obtained were processed and utilized with minimum delay for biochemical studies. Normal human eye balls without any pathological changes were obntained from C.H.Samariya Eye Bank, Red Cross Society, Dholaka Branch, Ahmedabad. A small incision was given surrounding the cornea to remove AQH using a syringe.

All chemicals used for this study were of analytical grade. The rare chemicals were obtained from Sigma-USA., E- Merck- Germany, Himedia-India, SRL-India, Loba Chemicals- India. All solutions were prepared according to the specified research standard methods. The above mentioned parameters were estimated by the standard methods and recorded on a DU-40 Beckman studied were analyzed statistically.

**RESULTS**

The biochemical parameters studied in aqueous humor of normal eye are mentioned in Table-1 which shows the relationship between the different age groups studied. The total sulphhydryl (TSH) content in AQH of the normal human eye remains more or less constant without any significant change. The value of TSH content being highest in the age group of 31-40 years and lowest in the age group of 41-50 years. The average value of TSH content of AQH of normal human eye is 3.34 uM per 100ml.
The ascorbic acid (AA) contents in AQH of the normal human eye decreases with increase in age. It is highest in the age group of 41-50 years whereas it is found to be lowest in the age group of 81-90 years. The decrease of ascorbic acid concentration is 31.38% in the last age group (81-90 Years) when compared to first age group (31-40 Years).

The total protein (TP) content in AQH of the normal human eye increases with age but decreases with increase in age above 70 years. It is highest in the age group of 61-70 years and lowest in the age group of 31-40 years. In all three parameters of table-1 the level of significance is less than 0.01.

Table -1  TSH, ASCORBIC ACID AND TOTAL PROTEIN CONTENTS IN AQH OF NORMAL HUMAN EYES

<table>
<thead>
<tr>
<th>AGE (Years)</th>
<th>TSH (uM / 100 ml)</th>
<th>Ascorbic Acid (uM / 100 ml)</th>
<th>Total Protein (mg / 100mk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-40</td>
<td>3.95 ± 0.11 (6)</td>
<td>131.6 ± 5.16 (8)</td>
<td>42.06 ± 4.7 (4)</td>
</tr>
<tr>
<td>41-50</td>
<td>2.55 ± 0.14 (8)</td>
<td>140.1 ± 4.31 (8)</td>
<td>43.93 ± 4.2 (5)</td>
</tr>
<tr>
<td>51-60</td>
<td>3.28 ± 0.10 (7)</td>
<td>114.3 ± 6.27 (8)</td>
<td>44.25 ± 5.5 (6)</td>
</tr>
<tr>
<td>61-70</td>
<td>3.40 ± 0.20 (7)</td>
<td>111.5 ± 5.03 (8)</td>
<td>53.88 ± 4.4 (6)</td>
</tr>
<tr>
<td>71-80</td>
<td>3.46 ± 0.05 (7)</td>
<td>95.5 ± 3.78 (8)</td>
<td>49.50 ± 4.5 (5)</td>
</tr>
<tr>
<td>81-90</td>
<td>3.16 ± 0.12 (8)</td>
<td>90.3 ± 4.12 (8)</td>
<td>50.10 ± 4.8 (5)</td>
</tr>
</tbody>
</table>

All Values are expressed as mean ± S.E.

Number in the parenthesis are sample sizes.

p-value < 0.01

DISCUSSION

The role of aqueous or physical and chemical nature of aqueous in relation to the changes of crystalline lens has not drawn the attention, it desires. The study undertaken in this research mention the correlation between aqueous composition and ageing of the eye as well the pathological changes of crystalline lens leading to its opacity called cataract. In crystalline lens various types of opacity occur during ageing and in other study of this research project has also been correlated by us with reference to aqueous i.e. the type of cataract and maturity of cataract.

The possible mechanism which increases protein level of AQH is altered permeability of lens fibers\(^3\). Histomorphologists show change in integrity of lens fibers. Another possibility of increase in protein level in AQH is increases secretion of protein from the cilliary processes.
It is reported by many scientists that proteins present in AQH are synthesized by ciliary processes. Another mechanism supporting the increased protein content in AQH is leakage of some small molecular weight lens proteins which cannot form a part of HMW proteins\textsuperscript{[1]}. 

The potential significance of the reaction of photooxidized aromatic compounds with proteins in the mechanism of cataract formation in ageing human lenses, and a number of other age-related pathological changes in other ocular tissues as well is established. Lens proteins would be increasingly pigmented with increased exposure to sunlight by this process\textsuperscript{[3]}

Ascorbic acid is a potent inhibitor of the photo – oxidation of tryptophan by near UV light\textsuperscript{[5]}

![Figure-2 Oxidative changes in aqueous humour](image)

As per out line above (figure-2) mentioned sequencial reactions the reducing and oxidizing properties of hydrogen peroxides, NADP(H), GSH, ascorbic acid are involved in protecting mechanisms to interact with each other. Thus it proves that formation of aqueous humour and its composition play very important role in protecting eye lens and other ocular tissue.

**REFERENCES**


5. Zigman, S. Gries, G., Yulo, T and Schultz J (1973) : Ocular protein alteration


