

# Analysis of glucose-6-phosphate dehydrogenase in anterior subcapsular and mixed cataractous lenses

M Balaji, K Sasikala, G Sundararajulu, T Ravindran, M Latheef Sathar

## Abstract

The study was undertaken to determine the different concentrations of glucose-6-phosphate dehydrogenase (G-6-PD) in anterior subcapsular and mixed cataractous lenses. In both types of cataractous lenses an increased concentration of G-6-PD was observed in 41-50 year age groups and a lower concentration of G-6-PD was noted in 61 year and above age groups. Cataractous lenses of females have a higher content of G-6-PD than males. In anterior subcapsular cataractous lenses, a lower concentration of G-6-PD was noted than in mixed lenses. (*Br J Ophthalmol* 1995; 79: 1124-1125)

Deficiency of glucose-6-phosphate dehydrogenase (G-6-PD) in cataract lenses has been reported by many researchers.<sup>1-4</sup> It is transmitted as an X linked character; in heterozygous women a wide range of G-6-PD deficiency<sup>4</sup> has been noted. There are few reports on G-6-PD deficiency in the lenses of human, mouse, ox, and rabbit.<sup>5-7</sup>

Owing to the paucity of information available in the anterior subcapsular and mixed human lenses in Tamil Nadu, India, we analysed the G-6-PD activity of lenses in patients with anterior subcapsular and mixed cataract, to study the levels of enzyme deficiency.

## Material and methods

This investigation was carried out on 300 patients. Cataractous lenses were collected from various eye hospitals of Coimbatore between January and May, 1994 and were categorised as anterior subcapsular and mixed cataracts as stipulated by the Oxford classification.<sup>8</sup> The age and sex of the patients were recorded. For controls, normal lenses of both sexes were obtained from an eye bank located in Coimbatore.

The lenses were collected in glass containers, washed with double distilled water, oven dried, and weighed separately. Glucose-6-phosphate dehydrogenase levels were assessed according to Zinkham's method,<sup>9</sup> and the data were analysed statistically by using Student's *t* test for significance.

## Results and discussion

Glucose-6-phosphate dehydrogenase content in lenses of males and females decreased as the age group of the patients increased. Lenses of females have larger amounts of G-6-PD than males in both anterior subcapsular and mixed

Table 1 Glucose-6-phosphate dehydrogenase content in lenses with mixed cataract

	No of subjects analysed	Glucose-6-phosphate dehydrogenase ( $\mu\text{mol NADP reduced}/100 \text{ mg protein h}^{-1}$ ) Mean (SD)
<b>Males:</b>		
Controls		
Group I	10	20.2 (2.11)
Group II	10	23.1 (2.22)
Group III	10	30.4 (2.80)
Experimentals		
Group I	25	17.3 (1.78)*
Group II	25	14.7 (1.68)*
Group III	25	13.8 (1.66)*
<b>Females:</b>		
Controls		
Group I	10	21.0 (3.06)
Group II	10	25.4 (3.48)
Group III	10	32.6 (3.67)
Experimentals		
Group I	25	18.0 (1.27)*
Group II	25	16.8 (1.20)*
Group III	25	14.8 (1.70)*

Group I: 41-50 years; Group II: 51-60 years; Group III: 61-70 years. \*Values significant at 5% level.

cataractous lenses (Tables 1 and 2). The age group and the G-6-PD content were found to be inversely proportional to each other in both anterior subcapsular and mixed cataractous lenses. When compared with their respective controls, a decreased content of G-6-PD was observed. The lenses of mixed cataract showed an increase in the content of G-6-PD compared with anterior subcapsular lenses.

The results of the present study showed that both the anterior subcapsular and mixed cataract lenses of females have more G-6-PD than those of males.

In the normal lens, G-6-PD is involved in a series of activities, as yet only partially known, that are indispensable for the growth of its cells

Table 2 Glucose-6-phosphate dehydrogenase content in lenses with anterior subcapsular cataract

	No of subjects analysed	Glucose-6-phosphate dehydrogenase ( $\mu\text{mol NADP reduced}/100 \text{ mg protein h}^{-1}$ ) Mean (SD)
<b>Males:</b>		
Controls		
Group I	10	20.2 (2.11)
Group II	10	23.1 (2.22)
Group III	10	30.4 (2.80)
Experimentals		
Group I	25	15.6 (2.25)*
Group II	25	13.5 (1.47)*
Group III	25	12.0 (1.82)*
<b>Females:</b>		
Controls		
Group I	10	21.0 (3.06)
Group II	10	25.4 (3.48)
Group III	10	32.6 (3.67)
Experimentals		
Group I	25	17.0 (1.80)*
Group II	25	15.2 (1.28)*
Group III	25	13.2 (1.14)*

Group I: 41-50 years; Group II: 51-60 years; Group III: 61-70 years. \*Values significant at 5% level.

Division of Human Genetics, Department of Zoology, Bharathiar University, Coimbatore-641 046, India

M Balaji  
K Sasikala  
G Sundararajulu

Department of Ophthalmology, Coimbatore Medical College, Coimbatore, Tamil Nadu, India  
T Ravindran  
M L Sathar

Correspondence to: M Balaji, H 10, Housing Unit, Punniakodi Road, RS Puram, Coimbatore-641 002, Tamil Nadu, India.

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and for the maintenance of transparency.<sup>10</sup> It has been demonstrated that a person with genetically determined deficiency of G-6-PD may be more susceptible to cataract formation.<sup>10</sup>

Glucose-6-phosphate dehydrogenase is an enzyme of the hexose monophosphate shunt which supplies NADPH<sub>2</sub>. This NADPH<sub>2</sub> is utilised by glutathione reductase for the generation of reduced glutathione.<sup>11</sup>

In conclusion, it was observed that the decreased content of G-6-PD in both male and female lenses, when compared with controls, could, owing to the deficiency of G-6-PD, affect the pentose pathways resulting in reduced glutathione activity, making the lens more prone to oxidative damage. Possibly, lipid peroxidation might be responsible for the loss of solubility and stability of the lens proteins.<sup>5 10 12</sup>

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