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DECREASED SERUM ZINC LEVELS IN PATIENTS WITH SENILE CATARACT

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ABSTRACT
Introduction: *Age related cataract is the leading cause of blindness in the world today and cataract extraction is the most often performed surgery. If a practical large scale intervention could slow the onset of cataract by ten years, the need for cataract surgery would be reduced by 45%. The causes of cataract are multiple, with nutrition playing a definite role. The usually high concentration of zinc in the ocular tissue, along with zinc deficiency being an established cause of Age Related Macular Degeneration, has led to an increasing interest in this trace element's potential role in Age related cataractogenesis.* ***Materials and Methods:*** *This study was conducted in The University of Health Sciences in collaboration with The Institute of Ophthalmology, Mayo Hospital, Lahore and The University of Animal and Veterinary Sciences, Lahore. The sample size was 50 patients with senile cataract. Serum of 35 age and sex matched controls were taken. These patients were undergoing trabeculectomy for glaucoma.* ***Results:*** *Zinc levels were measured in the serum, by atomic absorption spectrophotometry. The results supported the hypothesis that zinc deficiency could be one of the factors responsible for the development of senile cataract. Significant difference was observed in serum zinc levels of patients and controls ($P < 0.001$) showing that the patient serum zinc levels (0.896 ± 0.202 vs. 0.478 ± 0.278) are significantly lower than the serum zinc levels of controls.*

Key Words*: Serum Zinc levels, senile cataract, Atomic absorption spectrophotometry.*

INTRODUCTION

An increase in the prevalence of senile cataract is one of the consequences of an expanding population.[1,2] Age – related cataract is the major cause of blindness in the world today. More than 50 million people in the world suffer from age – related cataract and its prevalence in developing countries is significantly more than the developed ones.[3] The visual impairment due to cataract can be corrected surgically but at a significant societal cost. The cost of surgical procedures is a considerable part of the health budget of the developed nations[4] but unfortunately same cannot be said about the developing nations. Researching ways to delay age – related cataract would improve the quality of life for the older people and also reduce the economic burden caused by its surgical treatment.[5] If a practical, large – scale intervention could slow the onset of cataract by 10 years, the need for cataract surgery would be decreased by 45%.[6]

As the eye lens increases in age, it decreases in transparency.[7] This clouding is known as cataract and is one of the preventable causes of blindness accounting for about 42% of all blindness worldwide.[8] One contributing factor is oxidative stress which is known to be produced as a result of imbalance between production of reactive oxygen species (ROS) and their removal.[9] Superoxide dismutase (SOD) functions basically as a first order antioxidant enzyme, chiefly by neutralizing the effect of superoxide anion which is an important precursor for oxidative stress in the tissues.[10,11] Human SOD is mostly dependent on the metallic zinc ion for its catalytic activity[12] and structural stability.[13]

Zinc is the second most abundant trace element in the human body, and the total content is approximately two grams.[14,15] The normal plasma levels of zinc have been established to be 0.72 – 1.44 µg/ml.[17] The highest concentrations of zinc in the body are in the eye, prostrate and bone.[18] In the eye, zinc protects all the ocular tissues against oxidative damage and ocular birth defects.

A nutritional deficiency of zinc in humans is widespread in the developing world.[19] Among the adult population, the elderly are a potentially vulnerable subpopulation[20] due to multiple reasons such as low dietary zinc intakes[21] and an age – associated decrease in intestinal zinc absorption.[22] The decreased intake, poor absorption and excess excretion that are seen in the elderly may be associated with socioeconomic status and certain systemic disorders like diabetes and chronic liver or kidney diseases. Excessive use of certain trace minerals like calcium, copper and iron and some medications common to the elderly, such as diuretics, corticosteroids and penicillamine may also contribute to zinc deficiency.[18]

MATERIALS AND METHODS

A cross sectional analytical study design was employed for this experiment. A total of 50 male and female patients, aged 50 years and above and attending eye clinics of the Institute of Ophthalmology, Mayo Hospital, Lahore were sampled. Necessary clinical parameters were assessed by a physician and cataract was defined on the basis of slit lamp examination by an ophthalmologist. Another 35 age and sex matched elderly patients were selected for the control group. These patients were also selected randomly from among those attending the eye clinics for the management of glaucoma. Patients having already established risk factors like diabetes, hypertension, any other chronic illness, smokers and history of steroid intake were excluded.[23] All specimens were placed in metal – free test tubes and capped with paraffin film. About 5 ml of blood was taken and centrifuged to obtain serum. To 1 ml of serum, 2 ml of 5% trichloric acid and 7 ml of deionized water were added to bring up to a total volume of 10 ml. After this acid protein digestion the mixture was again centrifuged so that the insoluble precipitates settled down. The clear supernatant was filtered and brought up to a volume of 10 ml.[24-26] Zinc levels on all samples were determined in the same laboratory with a Hitachi flame atomic absorption spectrophotometer; model Z8230 at the University of Veterinary and Animal Sciences, Lahore. Data was entered and analysed using SPSS 16.0. Mean ± SD are given for quantitative variables. Independent sample t-test was applied. A p-value of $p<0.05$ was considered statistically significant.

RESULTS

The present study included 50 patients with senile cataracts, 20 males and 30 females. Ages ranged from 50 to 73. The study also included 35 age and sex matched controls.

Serum zinc levels in the study group ranged from 0.108 – 1.00 µg/ml on an average 0.479 ± 0.278 µg/ml. The average values for our study group were 0.482 ± 0.248 µg/ml for men and 0.476 ± 0.301 µg/ml for women. Serum zinc levels in the control group ranged from 0.589 – 1.40 µg/ml with an average 0.896 ± 0.202 µg/ml. The average values for our control group were 0.929 ± 0.197 µg/ml for men and 0.864 ± 0.206 µg/ml for women. Normal established values are 1.2 ± 0.20 µg/ml for men and 0.96 ± 0.13 µg/ml for women.[16] Significant difference was observed in serum zinc levels of controls and patients, $p < 0.001$ showing that the patient serum zinc levels (0.479 ± 0.278 vs. 0.896 ± 0.202) are significantly lower than the serum zinc levels of controls.

Statistical evaluation of data revealed no significant difference in zinc levels of male patients when compared to female patients in serum. The zinc levels in males and females were comparable and without any difference.

Table 1: *Mean of serum zinc levels of patients and control group.*

Parameters	Patient µg/ml Mean ± SD n = 50	Control µg/ml Mean ± SD n = 35	P-value
Serum	0.479 ± 0.278	0.896 ± 0.202	<0.001

Significant difference was observed in serum zinc levels of patients and controls. $P < 0.001$ showing that the serum zinc levels of controls are observed to be more than the patient serum zinc levels (0.896 ± 0.202 vs 0.479 ± 0.278).

Table 2: *Mean of serum zinc levels in males and females of the patient group.*

Parameters	Males µg/ml Mean ± SD n = 20	Females µg/ml Mean ± SD n = 30	P-value
Serum	0.482 ± 0.248	0.476 ± 0.301	0.939

No significant difference was observed in serum zinc levels of males and females in the study group (p-value = 0.939).

Table 3: *Mean of serum zinc levels in males of the control group.*

Parameters	Males µg/ml Mean ± SD n = 17	Females µg/ml Mean ± SD n = 18	P-value
Sera	0.929 ± 0.197	0.864 ± 0.206	0.342

No significant difference was observed in serum zinc levels of males and females in the control group (p-value = 0.342).

DISCUSSION

Although these results are from a relatively small sample population, they exhibit some thought – provoking findings. This is particularly important when we consider that there has been a good amount of controversy regarding the status of this trace element in serum and its possible role in senile cataractogenesis. So far, conflicting results have been reported on studies carried out on possible role of zinc in cataractgenesis across the world.

Akyol[26] in a study of cataract patients reported serum Zn concentration within the normal range and no significant difference was observed in patients with cataract and healthy subjects. Bhat[27] in a study in India showed that plasma levels of Zn were lower in patients compared to controls but Mohan[28] and his colleagues in a larger study were unable to demonstrate such an association. In the present study however, the serum zinc values in the patient group are significantly lower than the serum zinc levels of the control group ($p<0.001$).

Findings in this study show a relationship between zinc deficiency and increased occurrence of cataract among the elderly. However, whether these concentration changes are the actual cause of cataract development or are the consequence of disease itself needs to be further studied. Such studies need to be carried out to explore the role of zinc in the development of senile cataract. We should also carry out supplementation trials to assess the safety and efficacy of Zn dietary supplementation in the treatment of senile cataract.

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