



COMPARATIVE STUDY OF SERUM SODIUM AND POTASSIUM LEVEL CHANGES IN SENILE CATARACT PATIENTS WITH AGE-MATCHED CONTROL GROUP ATTENDING TERTIARY CARE HOSPITAL IN EAST INDIA.

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ABSTRACT: -

Background: - Amongst five senses vision is the most evolved sense in the human being. The lens is made up of 65% water and 34% of proteins. Cataract is among the most common ocular morbidity seen among elderly patients. People over 45 are typically affected by this so called senile cataract. Lens opacity, often known as cataract, affects around 75% of those over 75 and is the leading cause of blindness and poor vision worldwide. **Objective:** - Estimate the serum sodium and potassium levels in patients with senile cataract. To compare the electrolyte levels with the age matched healthy controls without cataract to identify significant differences. **Materials and Methods:** This was a hospital-based, prospective, cross-sectional comparative study was carried out in the Department of Biochemistry in collaboration with the Department of Ophthalmology at Gouri Devi Institute of Medical Science & Hospital. The study included 150 senile cataract patients over the age of 50 years, attending the Ophthalmology OPD, and 150 age-matched healthy controls. Serum electrolyte is measured by using an electrolyte analyzer. **Results:** In this study the case group consisted of 150 patients suffering from age-related cataract (77 female, 73 male) and the control group consisted of 150 healthy subjects who were attending the OPD for regular checkup or patient's bystanders (79 female, 71 male). Mean age and standard deviation of case and control groups were 61.72 ± 9.3 years and 59.46 ± 11.4 years, respectively. Age group of patients and controls were 50-75 years and 50-75 years respectively. Reference range for sodium was taken as 135-145 meq/l. **Conclusion:** According to our research, senile cataract patients had higher serum sodium levels than the control group; however, this was not the case for serum potassium levels. These results imply that high-sodium diets are a risk factor for senile cataract development.

INTRODUCTION:

Amongst five senses vision is the most evolved sense in the human being.^[1] The lens is made up of 65% water and 34% of proteins.^[2] Cataract is among the most common ocular morbidity seen

among elderly patients.^[3] Senile cataract, a condition that impairs one of our most valuable gifts the ability to see is one of the frequently observed effects of aging. People over 45 are typically affected by this so called senile cataract. Lens opacity, often known as cataract, affects around 75% of those over 75 and is the leading cause of blindness and poor vision worldwide.

Lens opacity is the first stage, which is followed by swelling, shrinking, and finally total loss of transparency.^[4] Age-related or senile cataract is the most prevalent type of cataract that primarily affects those over 45. The World Health Organization states that cataracts cause 51% of preventable blindness and 33% of visual impairment worldwide.^[5] A cataract is any opacification of the crystalline lens or its capsule. There isn't a single chemical explanation for senile cataract, hence its precise cause is still unknown. However, new research indicates that factors that may contribute to cataract development include senility, age, sex, metabolic disorders, exposure to ultra violet radiations, genetic predisposition, outdoor occupations, protein aggregates, oxidative stress and dietary factors. Numerous investigations have revealed that patients with cataracts have higher salt and potassium levels in their aqueous samples than age-matched people without cataracts.^[4,6]

About 50 million individuals worldwide are blind, with cataracts accounting for one-third of these cases. It is far more common in poorer nations than in industrialized ones. Eighty percent of curable blindness in India alone is caused by cataracts.^[7] In India, there are four million new cases of cataract found each year.^[8] The primary source of sustenance for the lens is aqueous humor. The serum is used to make this thin fluid. As a result, serum electrolyte concentration directly influences aqueous humor electrolytes, which in turn controls lens metabolism. It has been demonstrated that excess sodium replaces potassium in aqueous humour, changing the ratio in cataract patients. The alterations in the serum cations were blamed for this. Serum electrolyte imbalance seems to be one of the risk factors for cataractogenesis because this fluid is formed from plasma.^[7]

The main function of the lens is to refract the light to focus it on the retina.^[9] In contrast to aqueous humor, the lens has low sodium and high potassium. The Na^+/K^+ ATPase pump and the lens capsule's permeability maintain the equilibrium of sodium and potassium cations.^[10]

These cation concentrations of aqueous humor are altered by changes in the electrolyte composition of the plasma, which can eventually impact lens metabolism and result in cataract development.^[2] Serum sodium and potassium levels may be impacted by hypertension, other systemic illnesses, or drugs. When collecting the sample, people like these must be excluded.^[9] The thick lens is surgically removed as the primary treatment.^[10]

In order to improve prevention, diagnostic, and treatment approaches, it aims to shed light on their connection to cataract development.

AIMS AND OBJECTIVES:

1. Estimate the serum sodium and potassium levels in patients with senile cataract
2. To compare the electrolyte levels with the age matched healthy controls without cataract to identify significant differences.
3. To study the association of serum electrolytes with role of these electrolytes in the pathogenesis of cataracts formation.

MATERIALS AND METHODS:

This was a hospital-based, prospective , cross-sectional comparative study was carried out in the Department of Biochemistry in collaboration with the Department of Ophthalmology at Gouri Devi Institute of Medical Science & Hospital,(a tertiary level teaching hospital in East India), Durgapur, WB, India, from January 2022 to October 2022. The study included 150 senile cataract patients over the age of 50 years, attending the Ophthalmology OPD, and 150 age-matched healthy controls. The sample size was calculated using Open Epi software with a 95% confidence interval,. The study received approval from the Institutional Ethics Committee (IEC) of Gouri Devi Institute of Medical Science & Hospital, All the subjects were informed about the scientific nature of the study and

written informed consent was obtained from all participants. Serum electrolyte is measured by using an electrolyte analyzer.

Group1: Senile cataract patients, who were posted for cataract surgery.

Group2: Normal healthy individuals without cataract, who were attending to OPD for routine checkup (age and sex matched with group 1)

INCLUSION CRITERIA:

- 150 patients with cataract attending the OPD of Department of Ophthalmology, Gouri Devi Institute of Medical Science & Hospital.
- Patients aged above 50 years.
- 150 age-matched healthy individuals.
- Both sexes were included.

EXCLUSION CRITERIA:

- Patients with congenital cataract, traumatic cataract, complicated cataract.
- Patients with pre-existing ocular diseases like glaucoma, corneal opacity.
- Patients with history of diabetes mellitus, hypertension, cardiac diseases, hepatic disorders or renal disorders.
- Patients with a history of drug intake such as statins, steroids and chemotherapy.
- Patients with a history of smoking and alcohol consumption.

COLLECTION OF BLOOD SAMPLE FOR THE STUDY:

Using a sterile needle and syringe, 5 milliliters of blood were collected from the antecubital vein under aseptic circumstances. After that, the blood was put into clot activator tubes which was already labeled, and it was left to coagulate at room temperature. The samples were centrifuged for 3 to 5 minutes at 3000 rpm in order to separate the serum. Every sample has the correct codes and labels. Whenever possible, tests were carried out right away; if not, serum aliquots were kept between 2 and 8°C until analysis.

RESULTS:

In this study the case group consisted of 150 patients suffering from age-related cataract (77 female, 73 male) and the control group consisted of 150 healthy subjects who were attending the OPD for regular checkup or patient's bystanders (79 female, 71 male). Mean age and standard deviation of case and control groups were 61.72 ± 9.3 years and 59.46 ± 11.4 years, respectively. Age group of patients and controls were 50-75 years and 50-75 years respectively. Reference range for sodium was taken as 135-145 meq/l.

Gender	Group-1 (Senile Cataract Patients)		Group-2 (Control, Without Cataract)	
	No. of Participants	Percentage(%)	No. of Participants	Percentage(%)
Male	73	48.67 %	71	47.33 %
Female	77	51.33 %	79	52.67 %
Total	150		150	

Table-1: Age and sex wise distribution in two groups.

Table-2: Mean Serum Sodium and Potassium levels

Serum Electrolyte Levels	Senile Cataract group	Control group	P value
Serum Sodium (meq/l)	145.87 ± 3.57	142.23 ± 2.26	0.0013*
Serum Potassium (meq/l)	4.37 ± 0.42	3.91 ± 0.24	0.1016***

*** (P>0.05) No significant; ** (P<0.05) Significant; * (P<0.001) Highly significant.

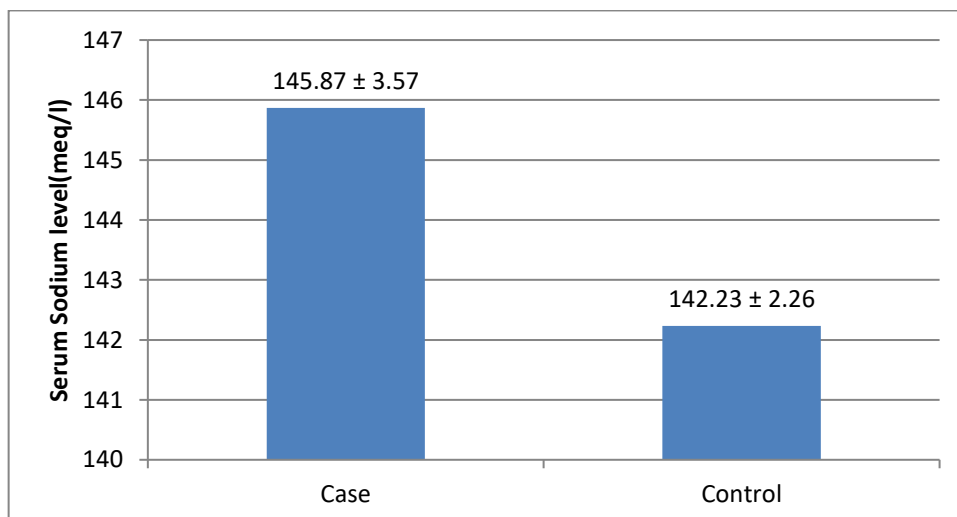


Figure 1: Comparison of serum sodium levels in cases and controls

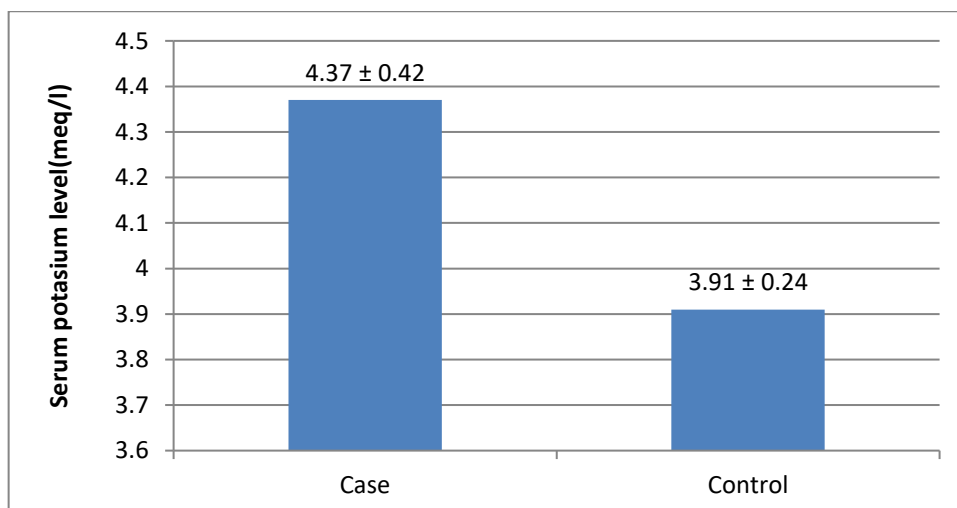


Figure 2: Comparison of serum potassium levels in cases and controls

The association of serum electrolytes and risk of cataract formation is studied by odd's ratio studied in sodium. In our study, we observed that, formation of cataract occurred in high sodium. Chances of senile cataract formation is greater in people with serum sodium >145 meq/l.

	Senile Cataract	Control
Increased serum sodium	98 (a)	47 (b)
Normal serum sodium	52 (c)	103 (d)
Total No.	150	150

Table 3: Odd's ratio for serum sodium

Odd's ratio = ad/bc

= (98x103) / (52x47)

= 4.13

Prevalence of Cataract is 4.13 times more in persons with higher serum sodium compared to normal healthy controls.

DISCUSSION:

The connection between human metabolic components and cataract development has been the subject of numerous investigations. Some researchers have recently postulated many reasons for

cataract formation, including osmotic graduation, protein aggregation, oxidative stress, and nutritional variables including vitamins. Result of this study shows elevated serum sodium level in cataract patients i.e. mean 145.87 ± 3.57 compared to control 142.23 ± 2.26 which is statistically highly significant (p value < 0.0013). According to this study, elevated sodium levels in cataract patients may worsen the condition if they continue. Because sodium pumps may find it more difficult to maintain the low intracellular Na level necessary for lens transparency when serum sodium levels are increased (Table 2).

One explanation for the correlation between elevated serum Na^+ and senile cataract could be that the lens is primarily nourished by aqueous humor. The blood plasma is used to create this thin fluid. Consequently, the concentration of serum electrolytes directly influences the electrolyte concentration of aqueous humor, which in turn controls the metabolism of lenses.^[7,11]

Cellular junctions and cation permeability undergo significant alterations as we age. In order to create novel variations with impaired functions, the key gap junction protein MIP26 loses some of its amino acids.^[12,13] As a result, an isolated, perfused human lens's membrane potential shifts from roughly -50 mV at age 20 to -20 mV at age 80.

Mirsamadi M., et al in a study reported that significantly higher levels of serum sodium in the cataract group. However serum potassium levels were not significantly high in cataract group when compared to normals which is comparable to our study.^[5]

Masood T. et al. concluded that Serum sodium levels in senile cataract patients were found to be higher as compared to control group but this did not hold true for serum potassium levels.^[14]

Soni PN, et al in a study reported that significantly higher levels of serum sodium in the cataract patients. However serum potassium levels were not significantly high in cataract group when compared to normal subjects which is very similar to our study.^[15]

CONCLUSION:

According to our research, senile cataract patients had higher serum sodium levels than the control group; however, this was not the case for serum potassium levels. These results imply that high-sodium diets are a risk factor for senile cataract development. Reducing sodium consumption may aid in slowing the development of cataracts. To corroborate these results, more research comparing the development of cataracts with other dietary practices is needed.

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