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Senile cataract: A result of disharmony in plasma levels of vitamin B_{12}, folate and homocysteine

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Abstract
Impaired vision due to cataract is the leading cause of blindness worldwide. The pathogenesis of senile cataract is considered to be multifactorial in nature. The metabolism of Homocysteine is done with the help of Vitamin B_{12} and Folate, which converts the same to methionine. Therefore, it can be deduced that Vitamin B_{12} and Folate act as strong preventive factor for cataract. The present study was conducted with collaboration of Department of Biochemistry at AIIMS, Patna and Department of Ophthalmology, DMCH, Dumka. This study included 50 cataract patients and 20 age matched control subjects. A statistically significant elevation in the level of Homocysteine was observed ($p<0.001$) in cataract patients as compared with that of control subjects. The plasma levels of folate were observed to be lesser in cataract patients with statistical significance ($p<0.001$). The random blood glucose levels of patients in the present study were within the normal range, suggesting that hyper-homocysteinemia along with decreased levels of Folate and Vit. B_{12} can play a significant role in development of cataract in addition to absence of hyper-glycemia or any other virtual metabolic and nutritional disorder as was evident by total protein and albumin levels.

Keywords: homocysteine, cataract, folate, vitamin vit, b_{12}

Introduction
The word "Cataract" is derived from Latin word *"cataracta"*, meaning *"waterfall"*. It can be defined as a clouding of the lens in the eye which may lead to a decrease in vision. Impaired vision due to cataract is the leading cause of blindness worldwide. Cataract can be classified, anatomically as nuclear or cortical, congenitally or developmental cataract, acquired variety which further comprises of metabolic, traumatic and senile cataracts [1-3].

Senile cataract is an age-related, vision-impairing disease characterized by gradual progressive clouding and thickening of the lens of the eye. It is the world's leading cause of treatable blindness. The pathogenesis of senile cataract is considered to be multifactorial in nature, i. e. no single component is found till date to cause senile cataract independently. The factors can be classified as genetic, environmental, socio-economic, nutritional, and systemic factors [4-6].

In India, various nutritional ingredients were reported to be associated with increased risk of cataract. One of these nutrient is homocysteine, it has been documented that in conditions such as exfoliation syndrome, glaucoma, and cataract, its plasma level is elevated. The metabolism of Homocysteine is done with the help of Vitamin B_{12} and Folate, which converts the same to methionine. Therefore, it can be deduced that Vitamin B_{12} and Folate act as strong preventive factor for cataract [7-10].

The present study was undertaken to study the correlation in plasma level of Vitamin B_{12} and Folate with that of homocysteine in patients suffering from senile cataract and that from control population.

Materials and Methods
The present study was conducted with collaboration of Department of Biochemistry at AIIMS, Patna and Department of Ophthalmology, DMCH, Dumka. This study included 50 cataract patients and 20 age matched control subjects. Samples were collected from cataract patients admitted in Ophthalmology ward prior to cataract surgery.

Inclusion criteria
1. Cataract patients were selected based on the vision less than 6/18 and visible opacity in the lens.
2. Age range was 50 – 70 years.
3. Patients and control population were normotensive and non-diabetic.

Exclusion Criteria
1. Patients and control subjects were on vitamin, mineral or any other supplementation.
2. Patients and control subjects were on anti-hypertensive drug therapy.

Random blood samples were collected from individuals of both the groups and non-hemolysed plasma was utilised for examining all biochemical parameters. Assays were carried out by using well-established and sensitive methods for homocysteine, Folate, Vitamin B_{12} by Chemi luminescence (Immulite analyzer) using reagent kits obtained from DPC [20], Protein estimation was done by Biuret method [12], Albumin by BCG method [13] and Random blood glucose by GOD-POD method [14] in the Dade behring Auto analyser. The reagent kits for total protein and albumin were obtained from Bio systems S.A. (Costa Brava 30, Barcelona, Spain) and that for blood glucose estimation was obtained from Reckon Diagnostics P. Ltd (Gorwa,Baroda-390 016,India) Statistical analysis was done by using student's 't' test for comparison between the groups and correlation was done by

Pearson correlation in Microsoft excel and P values < 0.05 were considered as statistically significant.

Results and Observations

On examining the plasma levels of the concerned biochemical parameters, a statistically significant elevation in the level of Homocysteine was observed ($p<0.001$) in cataract patients as compared with that of control subjects. The plasma levels of folate were observed to be lesser in cataract patients with statistical significance ($p<0.001$). Though the plasma Vit. B_{12} level of cataract patients was lesser than that of control subjects but the observed value was statistically significant. (Table 1)

Table 1: shows comparisons of Homocysteine, Vit. B_{12} and Folate levels in cataract patients with control subjects.

Parameters	Case (n = 50)	Control (n = 25)
Age	62.15 ± 7.52	61.32 ± 6,91
Homocysteine (µmol/L)	23.13 ± 8.11**	5 ± 2.90
Vitamin B12 (pg/ml)	193.8 ± 158.60	261.32 ± 89.54
Folate (ng/ml)	3.23 ± 1.44**	7.18 ± 3.11
Total Protein (gm/dl)	7.42 ± 0.08	7.22 ± 0.68
Albumin (gm/dl)	4.14 ± 0.33	4.32 ± 0.46
Random blood glucose (mg/dl)	99.12 ± 13.6*	115.3 ± 15.43

Values are expressed as mean ± SD; **P value < 0.001; *P value < 0.05

Both Homocysteine & Vit. B12 and Homocysteine & Folate were observed to have negative correlation with statistical significance in cataract patients (Table 2).

Table 2: Shows correlation analysis in cataract patients

Pairwise correlation of parameters	r - value
Homocysteine & Vit. B_{12}	-0.68**
Homocysteine & Folate	-0.47*

**P value < 0.001; *P value < 0.001

Discussion

The normal plasma level for Homocysteine is 5-12 µmol/L. The metabolisation of Homocysteine to methionine is done by Folate and Vit B_{12}. Conditions leading to hyper-homocysteinemia includes: 1) Vit B_{12}, Folate deficiency and heterozygous or homozygous trait for Methyl tetra hydro folate Re ductase, 2) Heterozygous or homozygous trait for cystathionine -β-synthase activity, 3) Renovascular stenosis and volume retention. In present study a correlation of hyper-homocysteinemia with age, and deficiency of Folate and Vit. B_{12} was observed. Hyper-homocysteinemia causes oxidative stress by generating reactive oxygen species. This oxidative stress could lead to senile cataract [15-19].

The present study observation helps in deduction of the fact that a significant decrease in Folate level and that of Vit B_{12} level acts as strong determinant of hyper-homocysteinemia in old age individuals. This observation relates with the findings documented in previous literature.

The random blood glucose levels of patients in the present study were within the normal range, suggesting that hyper-homocysteinemia along with decreased levels of Folate and Vit. B_{12} can play a significant role in development of cataract in addition to absence of hyper-glycemia or any other virtual metabolic and nutritional disorder as was evident by total protein and albumin levels. Further study is required to associate the disharmony of plasma levels of homocysteine, Folate and Vit. B_{12} with senile cataract.

Competing interests

The author(s) declare that they have no competing interests.

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