

<https://doi.org/10.48047/AFJBS.6.14.2024.4483-4493>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

## THE INFLUENCE OF TYPE 2 DIABETES MELLITUS ON LENTICULAR THICKNESS IN PATIENTS UNDERGOING CATARACT SURGERY

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Volume 6, Issue 14, Aug 2024

Received: 09 June 2024

Accepted: 19 July 2024

Published: 08 Aug 2024

[doi: 10.48047/AFJBS.6.14.2024.4483-4493](https://doi.org/10.48047/AFJBS.6.14.2024.4483-4493)

### Abstract:

**Introduction:** The prevalence of diabetes is increasing exponentially often causing an enormous public health burden. Patients with diabetes mellitus can develop various ocular complications including cataract, optic neuropathy, retinopathy. Cataract is a global health problem and is considered as a major cause of visual impairment in diabetic patients.

**Material & method:** The descriptive study was carried out in the department of Ophthalmology at Sapthagiri Institute of Medical Science and Research Centre, Bangalore in the year 2021-2022. A purposive sampling of 50 diabetic and 50 non diabetic patients of both gender and aged above 40 years were included for the study. lenticular thickness was measured using the A-scan machine and the correlation of the lenticular thickness with that of HbA1c was done.

**Results:** The mean lenticular thickness of the non diabetic group is 4.03mm  $\pm$  0.454. Where as the diabetic group is 4.24mm  $\pm$  0.517, P Value is 0.037 and is significant. Which is indicative of significantly more lenticular thickness in the diabetic group when compared to non diabetic group. with mean age in control group 62.5 years & in diabetic 61.3 years. The HbA1c Concentration was increasing with interval in diabetic group compared to non diabetic group as in group A (HbA1c >5.5 to 7) with the mean lens thickness in diabetic was 4.12mm, in group B (HbA1c >7.1 to 9) it was 4.18mm, in group C (HbA1c >9) it was 4.24mm, Which was comparatively more than the mean lens thickness of non diabetic patients is 4.03mm. HbA1c level in diabetic & significantly increasing with early age group of 61 yrs patients when compared to the non diabetes group patients & more in males than females.

**Conclusion:** These results will help the ophthalmic surgeon in planning of the surgeries also help in bringing about social as well as self-awareness and the precautionary measures that one can follow to avoid such complications by controlling blood glucose level through either modifying their lifestyle or by any other means possible.

## INTRODUCTION

Diabetes Mellitus(DM) affects hundreds of millions of people worldwide, resulting in considerable morbidity and mortality. The global prevalence was estimated to be 2.8% in 2000 and is expected to reach 4.4% by 2030. <sup>1</sup> Diabetes mellitus may lead to multisystem complications, involving especially the eyes, kidneys, nerves, heart, and blood vessels<sup>4</sup>. Patients with diabetes mellitus can develop various ocular complications including cataract, optic neuropathy, uveitis, keratopathy as well as retinopathy. <sup>2</sup> The crystalline lens is a major determinant of refraction. The increase in the lens thickness with increasing age in diabetic patients is probably either because of over-hydration or increased growth of the individual lens fibers continually added over a period of time. <sup>3</sup> & it is also affected by age, sex, cataract and diabetic status.<sup>4</sup> The sagittal width of the lens is about 4 mm at birth. <sup>5</sup> After second decade of life, lens thickness increases continuously by about 0.15-0.2 mm per decade. <sup>6</sup> Lenticular thickness According to WHO, 2-hour post-load plasma glucose after a 75 g oral glucose tolerance test (OGTT) in people with fasting plasma glucose values was  $\geq 126$  mg/dl, 2-hour post-load plasma glucose was  $\geq 200$  mg/dl <sup>2</sup> or a random blood glucose  $\geq 200$  mg/dl in the presence of signs and symptoms are considered to have diabetes mellitus. <sup>7</sup> Cataract is a global health problem and is considered as a major cause of visual impairment in diabetic patients. The prevalence of cataract-related blindness is 2% in people over 50 years of age.<sup>8</sup> To best of our knowledge as little is known about correlation of various concentration of blood glucose on lenticular thickness. Our study is taken up with the objective to measure the lenticular thickness in the diabetic and nondiabetic patients undergoing cataract surgery & to correlate the lenticular thickness with various HbA1c levels.

## MATERIAL & METHODS:

The descriptive study was carried out in the department of Ophthalmology at Saphthagiri Institute of Medical Science and Research Centre, Bangalore in the year 2021-2022. A purposive sampling of 50 diabetics and 50 non diabetic patients of both gender and aged above 40 years were included for the study. Inclusion criteria were patients diagnosed with type-2 diabetes mellitus & non diabetic patients as control, of both aged 40 years & above, both gender &

patients with informed consent. Exclusion criteria was patients with any other co-morbidities such as pseudo-exfoliation and history of any trauma & patients without consent. The following measurements were done are after taking the consent form signed from the patient. All the patients had undergone complete ophthalmologic examination including visual acuity, refraction and slit-lamp examination, lenticular thickness was measured using the A-scan machine (Appa max A scan) . The lens thickness of the patients was measured using an A-scan. Glycemic control was categorized as normal (HbA1c <5.6%), The patients were categorized into three groups with HbA1c levels, and the correlation of the lenticular thickness with that of HbA1c was done<sup>9</sup>. as group A good (5.6-7.0%), group B as fair (HbA1c 7.1-8.0%) & group C as unsatisfactory (HbA1c 8.1-10.0% & above) .Preceding the study, ethical approval from the institutional research ethical committee was taken. Data were collected and analyzed using statistical software SPSS version 21. Preliminary analysis was carried out and the results were presented as mean in both the groups in the form of Descriptive Statistics and Inferential Statistics. Correlation between two variables was established by using Pearson correlation factor. A 'p' value less than 0.05 was considered as statistically significant and 95% CI was used as a measure of precision.

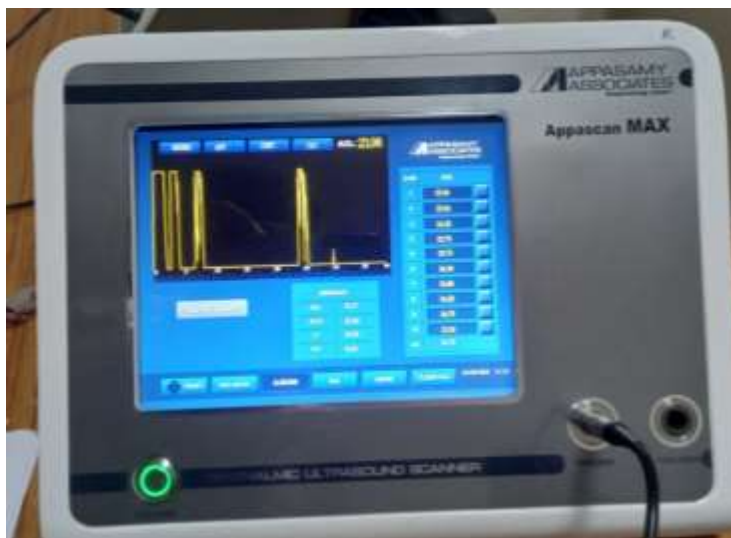


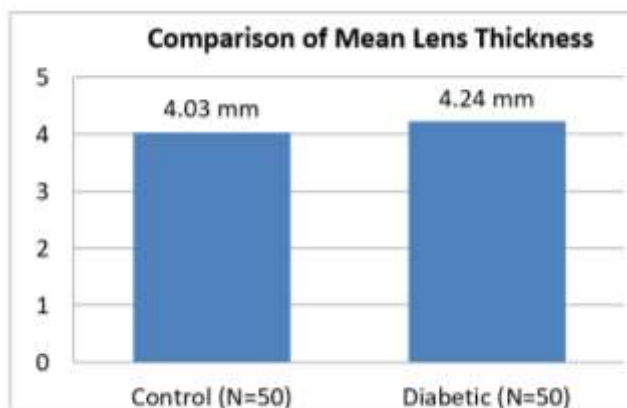
Photo number 1: showing A-SCAN MACHINE ( APPA max A-scan) to measure lenticular thickness

## RESULTS

|                  | NUMBER<br>OF<br>PATIENTS | MEAN<br>LENS<br>THICKNESS | SD    | MINIMUM –<br>MAXIMUM | P Value |
|------------------|--------------------------|---------------------------|-------|----------------------|---------|
| NON<br>DIABETICS | 50                       | 4.03 mm                   | 0.454 | 3.14 mm - 5.00 mm    | 0.037   |
| DIABETIC         | 50                       | 4.24 mm                   | 0.517 | 2.83 mm - 5.41 mm    |         |

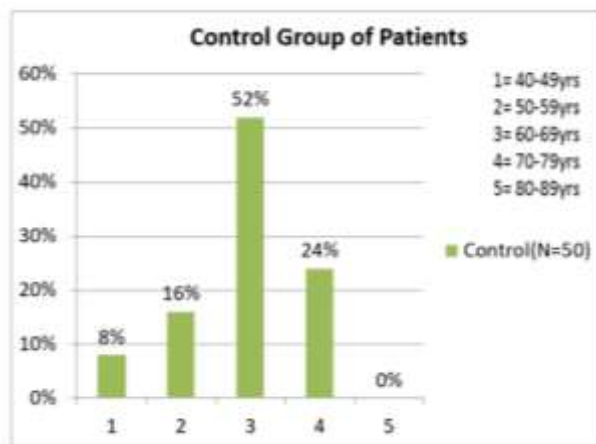
Table no.1: The Mean, Maximum & Minimum Lens Thickness In Diabetics And Non Diabetics Patients.

The mean lenticular thickness of the non-diabetic control group is 4.03mm  $\pm$  0.454 with a range of 3.14mm to 5.00mm. Whereas the diabetic group is 4.24mm $\pm$  0.517, with a range of 2.83mm to 5.41mm. P Value is 0.037 and is significant. Which is indicative of significantly more lenticular thickness in the diabetic group when compared to non-diabetic group.

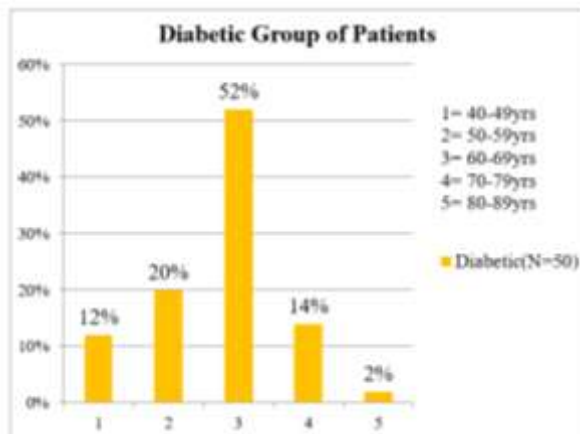


Graph no.1: The Mean Lenticular Thickness Of The Non Diabetic Group (50 Subjects)

The mean lenticular thickness of the non-diabetic group (50 subjects) is 4.03mm , whereas the diabetic group (50 patients) is 4.24mm.



Graph no.2: Age Wise Disribution of Non Diabetic Group Of Patients



Graph 3: Age Wise Disribution of Diabetic Group Of Patients

The age group of the range 60-90 years constitute the majority of the control non diabetic group & diabetic group i.e., 52% Showing that majority of the study population fall in group 3.

|  | GROUP | TOTAL |
|--|-------|-------|
|--|-------|-------|

| GROUP        | NUMBER OF PATIENTS | MEAN age | SD    | MINIMUM age | MAXIMUM age | P Value |
|--------------|--------------------|----------|-------|-------------|-------------|---------|
| NON DIABETIC | 50                 | 62.5     | 8.878 | 40          | 75          | 0.509   |
| DIABETIC     | 50                 | 61.3     | 9.802 | 40          | 89          |         |

Table No.3: Age wise distribution of control non diabetic & diabetic group of patients

The control group showed a mean age of 62.5 years $\pm$  8.878, with a minimum age group of 40 years and a maximum of 75 years. In the diabetic group, the mean age of 61.3 years $\pm$  9.802, with a minimum age of 40 years and a maximum of 89 years. P value is 0.509 and is insignificant. The mean age group in diabetics group is significantly more than non-diabetic group

| <b>GENDER</b> | NON DIABETIC (N=50) |     | DIABETIC(N=50) |     | TOTAL(N=100) |     |
|---------------|---------------------|-----|----------------|-----|--------------|-----|
|               | n                   | %   | n              | %   | n            | %   |
| <b>MALE</b>   | 34                  | 68% | 28             | 56% | 62           | 62% |
| <b>FEMALE</b> | 16                  | 32% | 22             | 44% | 38           | 38% |

TABLE NO 2: Gender Wise Distribution of Control Non Diabetic &amp; Diabetic Group of Patients

Male patients in both non diabetic (62%)& diabetic group are more than female patients (38%)

| <b>Group</b> | <b>HbA1c Concentration intervals</b> | <b>Number of cases</b> | <b>Mean lens thickness</b> |
|--------------|--------------------------------------|------------------------|----------------------------|
| <b>A</b>     | <b>5.5 to 7</b>                      | 12                     | 4.12mm                     |
| <b>B</b>     | <b>7.1 to 9</b>                      | 33                     | 4.18mm                     |
| <b>C</b>     | <b>&gt;9</b>                         | 5                      | 4.24mm                     |

IN TABLE NO.4: Showing HbA1c Concentration Intervals Groups & Its Correlation With Number of Cases & Mean Lens Thickness In Diabetics Patient Group

In group A (HbA1c >5.5 to 7) with The mean lens thickness in diabetic is 4.12mm in 12 diabetic patients. In group B (HbA1c >7.1 to 9) with The mean lens thickness in diabetic is 4.18mm in 33 diabetic patients. In group C (HbA1c >9) with The mean lens thickness in diabetic is 4.24mm in 5 diabetic patients. The mean lens thickness of non-diabetic(control) patients is 4.03mm. The

Mean lens thickness is significantly increasing with increase in HbA1c level in diabetic group patients than the non-diabetic group patients

The present study showed the mean lenticular thickness of the non-diabetic control group is  $4.03\text{mm} \pm 0.454$ . Whereas the diabetic group is  $4.24\text{mm} \pm 0.517$ , P Value is 0.037 and is significant. Which is indicative of significantly more lenticular thickness in the diabetic group when compared to control group. The age group of 52% falling in the range 60-90 years constitute the majority in both group with mean age in non-diabetic group 62.5 years & in diabetic 61.3 years, male patients in both non diabetic (62%) & diabetic group are more than female patients (38%). The HbA1c Concentration was increasing with interval in diabetic group compared to control group as in group A (HbA1c  $>5.5$  to 7) with the mean lens thickness in diabetic was 4.12mm, in group B (HbA1c  $>7.1$  to 9) it was 4.18mm, in group C (HbA1c  $>9$ ) it was 4.24mm, which was comparatively more than the mean lens thickness of non-diabetic(control) patients is 4.03mm.

## DISCUSSION:

| Sl No. | Authors                             | Year | Control No. | Lens thickness of Control Group. | Diabetic No. | Lens thickness of Diabetic Group. |
|--------|-------------------------------------|------|-------------|----------------------------------|--------------|-----------------------------------|
| 1      | Shristi Shrestha et.al <sup>9</sup> | 2013 | 144         | 4.05 mm                          | 144          | 4.33 mm                           |
|        | Li HY etal <sup>10</sup>            | 2010 | -           | -                                | 20           | 4.34mm                            |
|        | Fledelius                           | 1987 | -           | -                                | 62           | 4.74 mm                           |

|   |                                                   |      |     |         |     |         |
|---|---------------------------------------------------|------|-----|---------|-----|---------|
|   | HC <sup>11</sup>                                  |      |     |         |     |         |
| 2 | Khalada<br>Parvin<br>Deepa<br>et.al <sup>12</sup> | 2015 | 34  | 3.70 mm | 34  | 4.20 mm |
| 3 | Thomas AA<br>et.al <sup>1</sup>                   | 2018 | 100 | 3.56mm  | 100 | 3.76mm  |
| 4 | <b>Present<br/>Study</b>                          | 2022 | 50  | 4.03 mm | 50  | 4.24mm  |

Table no.5: Comparison of Lens Thickness In Diabetic & Non Diabetic Control Group f  
Poresent study with other Study

When compared to the other studies our study shows lesser mean value lenticular thickness compared to Shristi Shrestha et.al<sup>9</sup> studies, Li HY etal<sup>10</sup> studies & Fledelius *et al*<sup>11</sup> studies where mean lenticular thickness was more in diabetes than non-diabetes. Whereas mean lenticular thickness of present study was more than that of studies conducted by Khalada Parvin Deepa et.al<sup>12</sup> studies & Thomas AA et.al<sup>1</sup> studies. According to the study conducted in present study as well as others study, it was found that with increasing HbA1c levels the mean lenticular thickness was also increasing in diabetis group patients than non-diabetic control group. Logstrup *et al* demonstrated a higher correlation between duration of insulin dependent diabetes mellitus and lens thickness in monozygotic twins as compared with dizygotic twins.<sup>13</sup> The increase in the lens thickness in diabetic patients is probably either because of over-hydration or increased growth of the individual lens fibers. During the periods of hyperglycemia, there is accumulation of glucose in the lens which gets converted to sorbitol which is further converted into fructose. These sugar alcohols tend to accumulate within the lens fibers, as they are poorly permeable through the lens membrane. This creates an

osmotic gradient resulting in the influx of water into the lens producing marked lenticular swelling.<sup>14</sup>

## **Conclusions :**

The crystalline lens accounts for 20% of the total eye's refractive power. Any change in the morphology of the crystalline lens in patients with diabetes mellitus is associated with the alteration in the refractive status. In the present study mean lens thickness is more (P 0.037) & significantly increasing with increase in HbA1c level in diabetic & significantly increasing with early age group of 61 yrs. patients when compared to the control group patients & more in males than females. The results of the present study showed that diabetes had a profound effect in the lens thickness. These results will help the ophthalmic surgeon in planning of the surgeries. Larger lenticular thickness will require larger incision and hence preventing endothelial damage. With exponential increase in the cases of diabetes, this study will be of great importance in predicting correlation of HbA1c with one of the complications of diabetes i.e. lenticular thickness leading to cataract. This research will also help in bringing about social as well as self-awareness and the precautionary measures that one can follow to avoid such complications by controlling blood glucose level through either modifying their lifestyle or by any other means possible.

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