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### RESEARCH ARTICLE

## PSEUDOEXFOLIATIVE CATARACT AMONG NORTH AND SOUTH INDIAN PATIENTS- FIRST MULTICENTRIC TRIAL STUDY.

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#### Manuscript Info

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##### Key words:-

pseudoexfoliation, ultraviolet rays, cataract.

#### Abstract

**Background:** Pseudoexfoliation (PEX) syndrome is one of the identifiable cause cataract worldwide. The reported prevalences in different parts of the world have varied from 0% to 38% in different populations.

**Aim:** Our study, we report the prevalence and complications of PEX syndrome in a rural population in southern and northern India.

**Methods:** 1000 patients each from 6 geographically contiguous districts around Coimbatore district of the state of Tamil Nadu in South India and 6 geographically contiguous districts around Kanpur district of the state of Uttar Pradesh in North India for 1 year. Ophthalmic evaluation included recording of relevant ocular and medical history, were recorded.

**Results:** 1000 patients examined in South & North India, 600 people & 300 people had farming as their major occupation respectively. In south India, 100 (10%) were found to have PEX syndrome, whereas in North India, it was 60 (6%). The sex distribution reported a female preponderance. The mean age of subjects with PEX syndrome is 11.16 years older than the normal population.

**Conclusion:** Majority of study population in South India had farming as occupation with an average of 12-16 hours exposure to direct sunlight whereas in North India, majority were labourers with an average of 6-8 hours exposure to sunlight. More solar rays can reach the eye during the earlier decades of life as pupil size is known to be larger with younger age. This may be the most likely explain as to why pseudoexfoliation syndrome is more common among South Indians as compared to North Indians.

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#### Introduction:-

Pseudoexfoliation (PEX) syndrome is one of the identifiable cause cataract worldwide. It is a generalised disorder of the extracellular matrix characterised by the production of abnormal basement membrane-like material in several intraocular and extraocular tissues. The trigger for the production of PEX material remains to be identified. Clinically, the pseudoexfoliation material can be seen deposited in the anterior segment on the pupillary ruff, the anterior lens capsule, and other anterior segment structures. On the anterior capsule it has a characteristic distribution of a central disc surrounded by a clear zone, surrounded by a peripheral ring-like deposit of granular material. Associated anatomical features include pupillary ruff atrophy, pigment dispersion and, commonly, elevated intraocular pressures with or without glaucoma.<sup>1</sup>

The reported prevalences in different parts of the world have varied from 0% to 38% in different populations.<sup>2-5</sup> There are no population based data on the prevalence of pseudoexfoliative cataract among north and south indian population. In this study, we report the prevalence and complications of PEX syndrome in a rural population in southern and northern india.

### **Methods & materials:-**

The target population was identified by selecting a group of 6 geographically contiguous districts around Coimbatore district of the state of Tamil Nadu in South India and 6 geographically contiguous districts around Kanpur district of the state of Uttar Pradesh in North India. People aged 50 years or above residing in the target area were enumerated for cataract evaluation and willing people were motivated and brought to the base hospital for a comprehensive ophthalmic evaluation. The study was carried out after approval by the institutional review board. Written informed consent was obtained from all participants before the commencement of examination & surgery. The first consecutive 1000 people who were enrolled each in the respective centres were examined and operated between 15 July 2018 and 14 July 2019. Basic occupation of subjects along with age of initiation of work were documented. Questionnaires were assessed for most recent time spent outdoors and eyewear behaviors. (i.e., wearing of eyeglasses, hats or sunglasses).<sup>6</sup>

### **Eligibility criteria**

Those aged 50 years and above or those turning 50 in the current calendar year and resident at the target address for a minimum period of 6 months were eligible for inclusion.

### **Exclusion criteria**

People staying at the target households for a period of less than 6 months, temporary residents (people who have permanent residence elsewhere), and hostel dwellers were excluded. Very old people and/or invalids who could not be transported to the examination centre were also excluded from the study.

### **Examination procedures**

The ophthalmic evaluation included recording of relevant ocular and medical history, recording of best corrected visual acuity with logMAR chart, examination of the pupillary reaction, and slit lamp evaluation of the anterior segment with careful search for PEX deposits. Intraocular pressure (IOP) was recorded by Goldmann applanation tonometry. Gonioscopy was performed on all subjects using a Sussmann-type 4 mirror hand held gonioscope (Volk Optical Inc, Mentor, OH, USA). Gonioscopy was first done using a short beam that does not cross the pupil and indentation gonioscopy was performed whenever necessary. Subjects with open angles had their pupils dilated with 5% phenylephrine and 1% tropicamide eye drops. If phenylephrine was contraindicated, 1% homatropine eye drops were used instead. If the angles were found to be occludable the need for laser iridotomy was explained to the subject and it was performed after obtaining the subject's consent. The rest of the examination was deferred to another convenient date following the laser iridotomy.

Repeat slit lamp evaluation was done after dilatation. The anterior lens capsule was examined again for PEX deposits under dilatation. The subject was classified as having PEX syndrome if PEX material was present in either or both eyes. Cataract grading by LOCS II system was done in those patients where the pupil dilated to 6 mm or more.<sup>7</sup> Stereoscopic evaluation of the fundus and the optic disc with the indirect ophthalmoscope and the +78 D lens was performed followed by the optic disc stereophotography.

### **Diagnostic criteria**

Nuclear colour of NC I or more with nuclear opalescence N2 or more according to the LOCS II system was considered as significant nuclear sclerosis.

### **Statistical Analysis:-**

Collected data were entered in a database using Microsoft Access software.

In people with unilateral PEX, the eye with PEX was considered. In those with bilateral PEX and in the population without PEX, one eye was chosen at random.

For comparison of nuclear sclerosis, the eye with PEX was chosen for cases with unilateral PEX and one eye was chosen at random for cases with bilateral PEX. From the subjects who did not have PEX, a subset of age matched people was selected for comparison and one eye was chosen at random.

### Results:-

Of 1000 patients examined in South India, 600 people had farming as their major occupation with 250 being labourers and remaining staying at home. 500 people had started farming at an average age of 28-30 years. 100 (10%) were found to have PEX syndrome of which 65 were females and remaining 35 were males, with unilateral disease in 51 (51%) and bilateral in 49 (49%) subjects. Of those with unilateral disease, 23 (49.06%) were in the right eye and 28 (54.90%) were in the left eye. The mean age of subjects with PEX was 58.10 (SD 9.98) years while the mean age of subjects without PEX was 52.76 (12.86) years, the difference being significant (*t* test,  $p < 0.001$ ). The mean age of the unilateral PEX and bilateral PEX subjects was 53.72 (9.11) and 55.66 (9.14) years respectively, the difference being insignificant (*t* test,  $p = 0.143$ ).

Of 1000 patients examined in North India, 300 people had farming as their major occupation with 650 being labourers and remaining staying at home. 60 (6%) were found to have PEX syndrome, in which 45 were females and 15 were males with unilateral disease in 24 (40%) and bilateral in 26 (60%) subjects. Of those with unilateral disease, 12 (50%) were in the right eye and 12 (50%) were in the left eye. The mean age of subjects with PEX was 78.10 (SD 12.98) years while the mean age of subjects without PEX was 72.76 (13.86) years, the difference being significant (*t* test,  $p < 0.001$ ). The mean age of the unilateral PEX and bilateral PEX subjects was 73.72 (10.34) and 75.66 (11.65) years respectively, the difference being insignificant (*t* test,  $p = 0.143$ ).

10 (10%) patients of the 100 with pseudoexfoliation operated in South India underwent complications where 8 (8%) had small pupil which would not dilate more than 3mm. 6 (6%) had pre-existing zonular dialysis pre-operatively and remaining 4 (4%) had posterior capsular rupture intraoperatively.

4 (6.67%) patients of the 60 with pseudoexfoliation operated in North India underwent complications where 2 (3.33%) had small pupil not dilating more than 3mm. 1 (1.67%) had pre-existing zonular dialysis pre-operatively and remaining 3 (5%) had posterior capsular rupture intraoperatively.

**Table 1:-**Age specific prevalence of PEX syndrome- South India

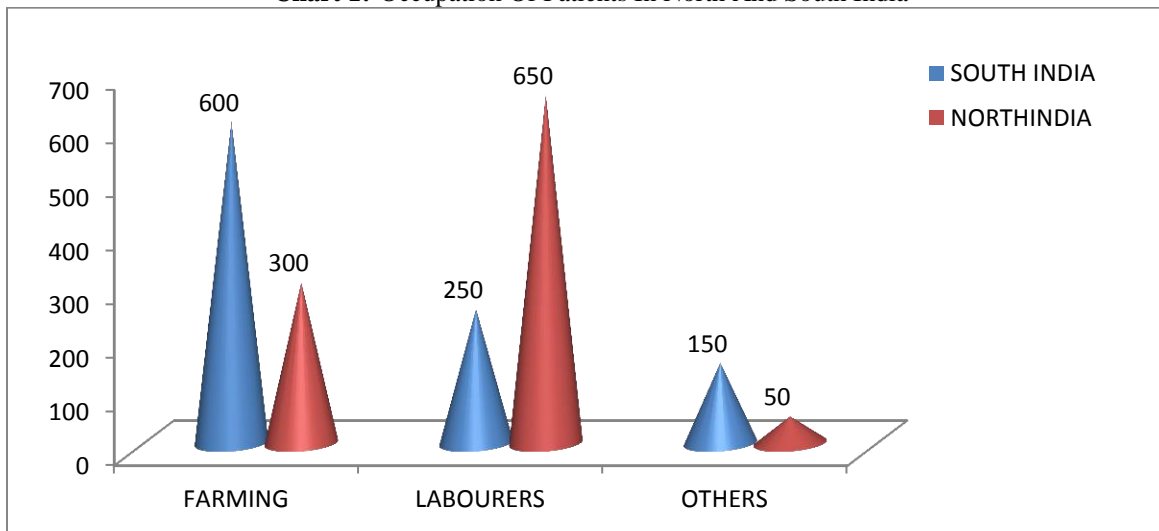
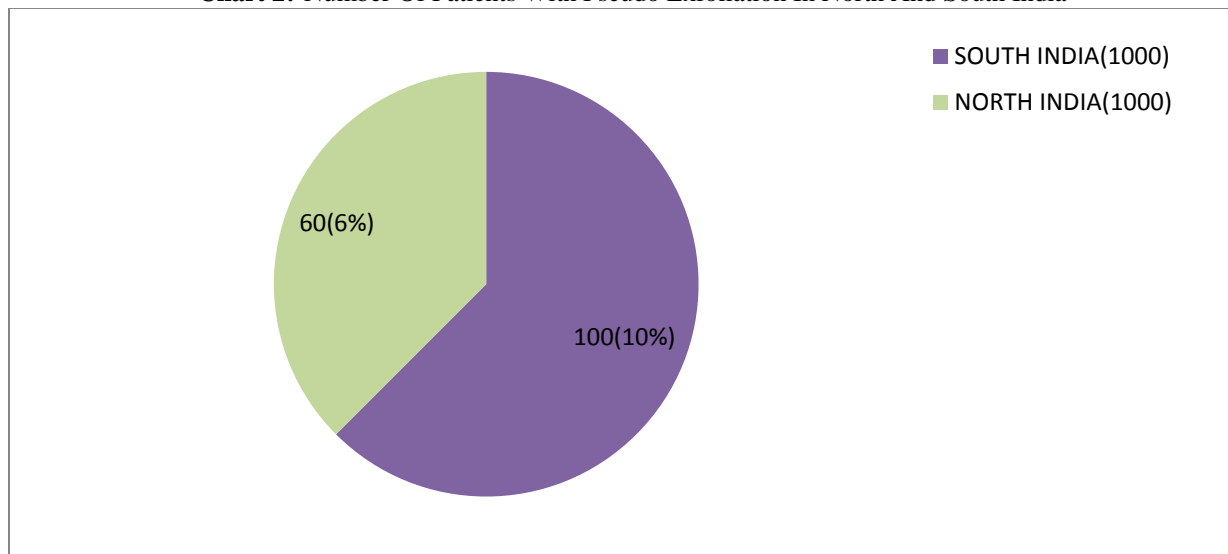
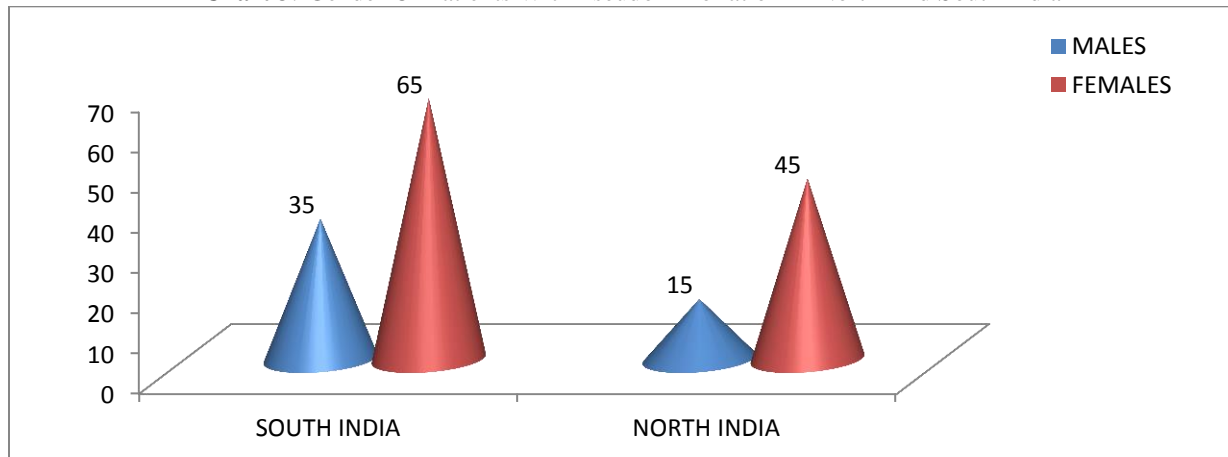
Age (years)	No of subjects with PEX	Total population	Prevalence (%)
50-59	16	61	2.6
60-69	40	598	6.69
70-79	30	268	11.1
>80	14	73	19.17

PEX = pseudoexfoliation.  $\chi^2$  analysis for trend:  $p < 0.001$ .

**Table 2:-**Age specific prevalence of PEX syndrome- North India

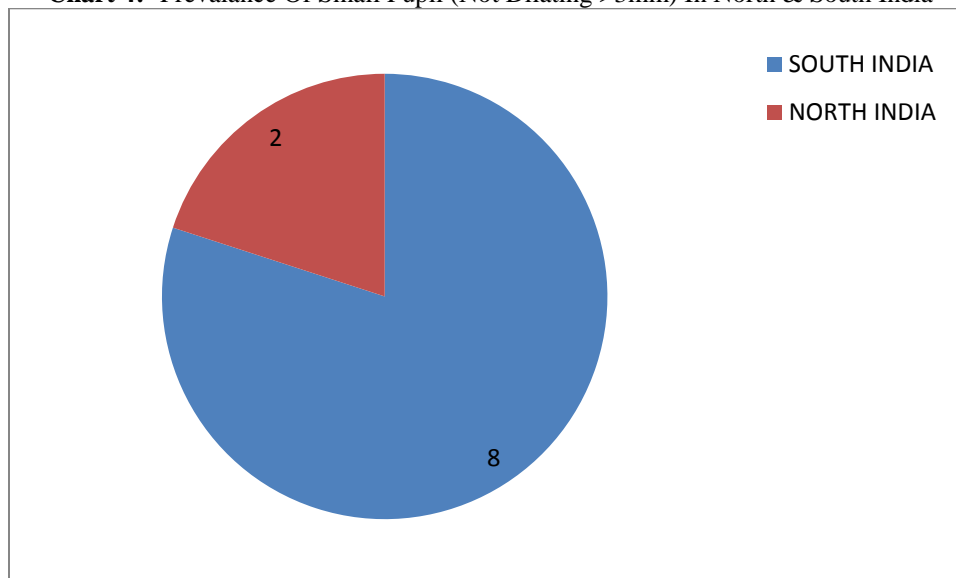
Age (years)	No of subjects with PEX	Total population	Prevalence (%)
50-59	5	145	3.44
60-69	26	587	4.43
70-79	23	221	10.4
>80	6	47	12.76

PEX = pseudoexfoliation.  $\chi^2$  analysis for trend:  $p < 0.001$ .

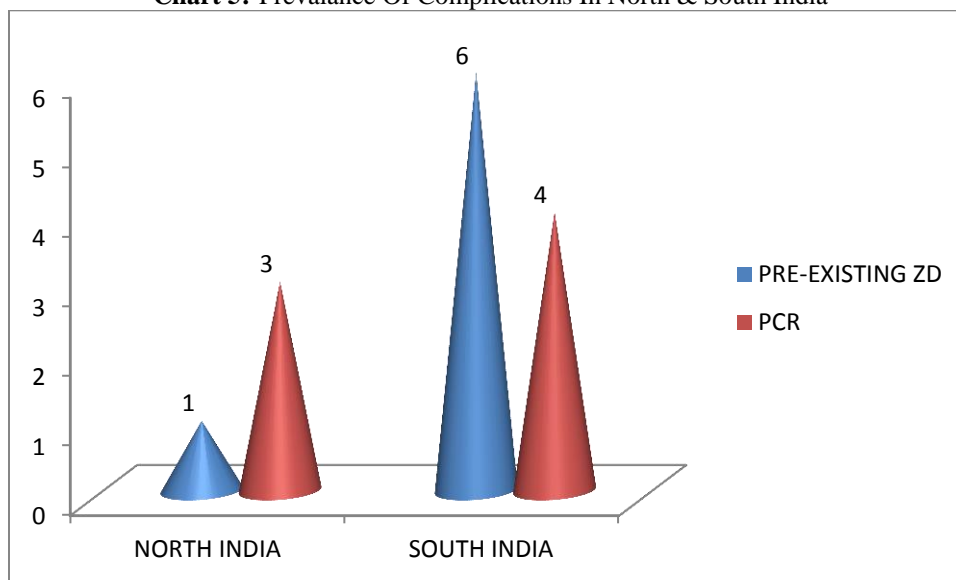
**Chart 1:-Occupation Of Patients In North And South India****Chart 2:-Number Of Patients With Pseudo Exfoliation In North And South India****Chart 3:-Gender Of Patients With Pseudo Exfoliation In North And South India**

**Table 3:-**Prevalance Of Small Pupil (Not Dilating >3mm) In North & South India

	PUPIL SIZE
SOUTH INDIA	8
NORTH INDIA	2

**Chart 4:-** Prevalance Of Small Pupil (Not Dilating >3mm) In North & South India**Table 4:-**Prevalance Of Complications In North & South India

	NORTH INDIA	SOUTH INDIA
PRE-EXISTING ZD	1	6
PCR	3	4
TOTAL	4	10

**Chart 5:-**Prevalance Of Complications In North & South India

## Discussion:-

The reported prevalence rate of PEX syndrome in different populations shows extensive variations—0% in Eskimos,<sup>8</sup> 1.6% in a south eastern US population,<sup>9</sup> 1.8% in the Framingham Eye Study,<sup>10</sup> 5–25 % in the Scandinavian countries,<sup>8</sup> and 38% in Navajo Indians.<sup>5</sup> More recent population based estimates in Australia reveal prevalences of 0.98% in the Visual Impairment Project<sup>11</sup> and 2.3% in the Blue Mountains Eye Study.<sup>12</sup> These could reflect true variations arising from racial, genetic, and/or geographical differences. However, they could also be accounted for by many other factors including differences in study design (prospective versus retrospective), sampling methods (population based, hospital based, or clinic based), population size, and age distributions in the sampled populations.

A literature search revealed only two reports on the prevalence of PEX syndrome in India. The first, by Sood and Ratnaraj in 1968, reported 1.87% prevalence in patients aged 45 years or above in patients with PEX.<sup>13</sup> The last report on the subject is by Lamba and Giridhar in 1984,<sup>14</sup> who reported a 7.4% prevalence of PEX. Both these were hospital based studies. The current study is the only population based study on PEX syndrome from North and South India. Our finding that nuclear sclerosis is more prevalent in the PEX population is in accordance with previous studies. The sex distribution in our study was similar to that of some studies that have reported a female preponderance.<sup>15</sup>

The cluster districts of Coimbatore & around in South India lie in the tropical region & on an average approximately 1225km (761miles) away from the equator, whereas the cluster districts of Kanpur & around in North India lie in the temperate regions & on an average approximately 2942km (1828 miles) with a difference of approximately 1717km (1067 miles between the two cluster districts.

We found that the mean age of subjects with PEX syndrome is 11.16 years older than the normal population. Considering age specific prevalence rates, there was a significant linear increase in prevalence with age. It is well known that the prevalence of PEX increases with age.<sup>9,11,12</sup> The bilateral cases were not significantly older than the unilateral cases. These findings are similar to those of other studies.<sup>15</sup>

Solar reflectivity may explain why residing at increasing latitude away from the equator and its association with an elevated risk of XFS. With increasing latitude away from the equator, the sun is more angulated with respect to the earth's surface, allowing for greater UVR reflectivity into the eye.<sup>16</sup>

## Conclusion:-

Majority of study population in South India had farming as occupation with an average of 12-16 hours exposure to direct sunlight who had started farming with an average age of 28-30 years. The counterparts in North India, majority were labourers with an average of 6-8 hours exposure to sunlight directly. Solar reflectivity off the surfaces can be quite significant, reaching up to 30% off of water during farming.<sup>17</sup> It is possible that more solar rays can reach the eye during the earlier decades of life as pupil size is known to be larger with younger age.<sup>18,19</sup> and that this time period plays an important role in the development of the disease,<sup>18</sup> as more time spent outdoors in younger age group. This may be the most likely explain as to why pseudoexfoliation syndrome is more common among South Indians as compared to their North Indian counterparts.

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