

# Frequency and Risk Factors of Dry Eye Disease in Pakistani Population, A Hospital Based Study

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**Purpose:** To determine prevalence and risk factors of dry eye in hospital based Pakistani population.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Department of Ophthalmology, Jinnah Hospital, Lahore. From April 2016 to June 2016.

**Materials and Methods:** Three hundred cases above 18 years of age who presented to out-patient department with various ophthalmic complaints were enrolled in the study. Patients with acute inflammatory conditions, acute infections, gross corneal or conjunctival diseases, contact lens wearers and those who had undergone any form ocular surgery within the last 6 months were excluded from the study. After taking detailed history, a pre-designed questionnaire was administered to the patients that inquired about various symptoms of dry eyes followed by a detailed ophthalmic assessment and measurement of tear film breakup time (TBUT) using fluorescein dye. Patients exhibiting TBUT < 10 seconds were labeled as dry eye sufferers.

**Results:** There were 300 participants enrolled in the study with mean age  $46.8 \pm 8.3$  years. 54.3% were female patients in the study. The prevalence of dry eye was found to be 18.7%. Patients aged more than 70 years showed significantly higher prevalence of dry eyes ( $p = 0.006$ ). There were 18.9% hypermetropes, 16.2% myopes and 15.2% emmetropes suffering from dry eyes. Multivariate regression analysis showed that outdoor workers, people working in air conditioners, housewives, diabetics, smokers, people exposed to excessive sunlight, wind, temperature, and patients suffering from meibomian gland dysfunction were at higher risk of developing dry eye.

**Conclusion:** Dry eye is associated with increasing age, female gender, outdoor occupations, smoking, diabetes, meibomian gland dysfunction and refractive errors.

**Key Words:** Dry eye, Frequency, Diabetes, Risk Factors.

Dry eye is caused by abnormalities in the tear film which consists of lipid, aqueous and mucous layers from anterior to posteriorly<sup>1</sup>. The definition of dry eye disease has been under continuous revisions in the recent past. The current diagnosis and definition of dry eye disease is based on 3 criteria as given in International Dry Eye Workshop

(DEWS) guidelines 2007: 1) decreased tear production or increased tear evaporation, 2) damage to the ocular surface, and 3) associated ocular discomfort or visual disturbance<sup>2</sup>. Various researchers have labeled dry eye as the most prevalent condition seen in ophthalmology clinics<sup>3</sup>. Due to tear film instability, dry eye patients report varying degree of stinging,

burning, irritation, foreign body sensation, watering, fatigue, redness and photophobia etc. in the affected eye. The symptomatology of dry eye may even be seen in the absence of full triad of features mentioned above that define dry eye disease.

Various studies have reported prevalence of dry eyes from 10% to 70% depending on the type of patients/subjects, diagnostic criteria and objective tear film tests used in the study<sup>3</sup>. Many factors have been reported in literature that are associated with dry eyes that include hot weather, windy air conditions, excessive sun exposure, pollution, smoking, advancing age in females, menopause etc<sup>4</sup>. Recently, a large prevalence of dry eye disease has been reported in computer users due to decreased blink rate during performance of visual tasks with deep concentration<sup>5,6</sup>.

We conducted a literature on Google Scholar, PubMed, EMBASE and Cochrane library to find out earlier researches on the subject from Pakistan. Only one study was found in which Jehangir et al had shown presence of dry eye disease with various other ocular pathologies<sup>7</sup>. We believe that climatic and environmental conditions of Pakistan mandate similar studies. We conducted this study with the objectives to determine prevalence and risk factors of dry eye in hospital based Pakistani population.

## MATERIALS AND METHODS

The study was conducted in Department of Ophthalmology of Jinnah Hospital, Lahore, a tertiary care hospital, from April 2016 to June 2016, after taking approval from Ethical Review Board/ Institutional Review Committee of Allama Iqbal Medical College/Jinnah Hospital, Lahore. The study was conducted following the principles of good clinical practice as laid down in Declaration of Helsinki. Informed written consent was taken from all the study participants.

We evaluated 300 cases above 18 years of age who presented to our out-patient department with various ophthalmic complaints. The patients were selected following consecutive purposive sampling. Only those patients were selected who consented to take part in the study. Patients with acute inflammatory conditions, acute infections, gross corneal or conjunctival diseases, contact lens wearers and those who had undergone any form of ocular surgery within the last 6 months were excluded from the study.

Three researchers (AB, FA, NS) recorded detailed ophthalmic and general history of the patients

focusing on main causations associated with dry eyes. Sun exposure raised outdoor temperatures, smoking, exposure to air pollutants and drugs were especially asked about. After detailed history, another researcher (MHnA) administered a pre-designed questionnaire about symptoms of dry eye. The questionnaire was administered in language of the patients and asked for socio-demographic data including age, gender, occupation, residence; and symptoms of dry eyes including recurrent watering, foreign body sensation (grittiness), itching, burning, stinging, dryness, soreness, heaviness etc.

Subsequently, a consultant ophthalmologist (MHdA) performed detailed ophthalmic examination of all the patients. During ocular examination, special attention was paid to ocular surface abnormalities, diseases of the eyelids, meibomian gland dysfunction, presence of any strands or filaments etc. Lastly, status of the precorneal tear film was assessed using tear film break-up time (TBUT). The test was performed at room temperature, keeping fans turned off after application of fluorescein dye in the inferior fornix. The patient was asked to blink 4 - 5 times to allow even distribution of fluorescein dye over the ocular surface. Finally, the patient was asked not to blink any further and was examined on slit lamp biomicroscope with cobalt blue filter. Time interval between last blink and appearance of first area of discontinuation in the precorneal tear film was TBUT. Patients exhibiting this interval to be less than ten seconds were labelled to be suffering from dry eyes. If any patient reported usage of ocular lubricants, his TBUT was measured after discontinuation of that medicine for at least 24 hours.

SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA) was used to do data analyses using 95% confidence intervals (CI). The likelihood ratio was used to calculate the *p*-values using Pearson Chi-square tests with a *p*-value of less than 0.05 considered as statistically significant. Associations of environmental risk factors with dry eye were assessed using regression analysis. The strength of association of environmental factors with dry eyes was found out by calculating odd ratio. The difference in the mean number of dry eye symptoms between dry eyed and normal individuals was assessed using analysis of variance test (ANOVA). A *p*-value < 0.05 was considered statistically significant.

## RESULTS

Three hundred patients participated in the study with mean age  $46.8 \pm 8.3$  years. There were 163 (54.3%) females and 137 (45.3%) males in the study. The

detailed socio-demographic characteristics of the patients are shown in Table 1. The most common presenting complaint of the patients with dry eyes was blurring of vision in 29 (51.8%) of the cases followed by recurrent watering and itching in 39.3% and 19.6% of the cases respectively (Table 2). The frequency of dry eye was found to be 18.7% (56 cases) in our study population. Patients aged more than 70 years showed significantly higher prevalence as compared with rest of the groups in 40.0% of the cases ( $p = 0.006$ ; 95% CI 1.346 – 5.780) (Table 3). A relative peak of dry eye prevalence was noted in age group 31-40 years (20.3%). As compared to males (16.1%), females showed significantly higher prevalence of dry eyes (26.4%) ( $p = 0.021$ ; 95% CI 1.080 – 2.631). Menopausal women showed higher prevalence than non-menopausal women 30.1% versus 21.5% respectively. Though the prevalence of dry eye came out to be more in rural population (20.6%) as compared with urban population (17.6%) ( $p = 0.611$ ; 95% CI 0.552 – 1.392), this result was not statistically significant. A detailed analysis of prevalence of dry eye according to age, gender and place of residence is presented in Table 3.

The most commonly affected people with dry eye were farmers and laborers 13 (27.1%) followed by high exposure individuals (4, 25.0%) that included professional computer users, professional drivers, field salesmen, field workers, outdoor painters, mechanics and cooks (Table 4). Odd's ratios to show strength of associations of various occupations, environmental factors, systemic illnesses and drugs with dry eye as measured through multivariate regression analysis are shown in Table 5. Briefly, outdoor workers, people working in air conditioners, housewives, diabetics, smokers, people exposed to excessive sunlight, wind, temperature, and patients suffering from meibomian gland dysfunction were at higher risk of developing dry eye.

As part of detailed ophthalmic examination, all patients underwent assessment of their refractive status as well. 15.2% of emmetropes suffered from dry eyes while 16.2% (16/105) myopes and 18.9% (22/116) hypermetropes were affected by this condition. The mean number of ocular symptoms in dry eye patients was significantly higher as compared to non-dry eye group:  $6.8 \pm 2.1$  versus  $3.4 \pm 2.3$  ( $p = 0.001$ ; 95% CI 1.69-2.86).

**Table 1:** Socio-demographic characteristics of participants in the Study (n = 300).

	Number of Subjects	Percentage (%)
<b>Age Groups (years)</b>		
21 – 30	70	23.4
31 – 40	59	19.7
41 – 50	62	20.6
51 – 60	55	18.3
61 – 70	34	11.3
Above 70	20	6.7
<b>Gender Distribution</b>		
Male	137	45.7
Female	163	54.3
<b>Residence</b>		
Urban	193	64.3
Rural	107	35.7
<b>Occupation</b>		
Farmers / Labourers	48	16.0
Others with High Exposure <sup>a</sup>	16	5.3

Indoor Office Workers/Shopkeepers	53	17.7
Others with Low Exposure <sup>b</sup>	55	18.3
Housewives/Students	123	41.0
Factory Workers	5	1.7

<sup>a</sup> Professional computer users, professional drivers, field salesmen, field workers, outdoor painters, mechanics, cooks etc.  
<sup>b</sup> Doctors, teachers, scientists, priests etc.

**Table 2:** Presenting symptoms of dry eye patients (n = 56).

Symptoms	Number of Participants	Percentage (%)
Blurred Vision	29	51.8
Watering	22	39.3
Itching	11	19.6
Heaviness	8	14.3
Burning	7	12.5
Stickiness	6	10.7
Dryness	5	8.9
Grittiness	4	7.1
Excessive Mucoid discharge	3	1.7

**Table 3:** Prevalence of dry eyes according to age, gender and residence.

	Number of Subjects	Dry Eye Subjects	Prevalence (%)	p-value	95% CI
<i>Age Groups (years)</i>					
21 – 30	70	10	14.3	0.110	0.381 – 1.118
31 – 40	59	12	20.3	0.502	0.671 – 1.898
41 – 50	62	10	16.1	0.182	0.471 – 1.394
51 – 60	55	9	16.4	0.990	0.485 – 1.620
61 – 70	34	7	20.5	0.054	0.551 – 2.121
Above 70	20	8	40.0	0.006	1.346 – 5.780
<i>Gender Distribution</i>					
Male	137	22	16.1	0.021	1.080 – 2.631
Female	163	43	26.4		
<i>Residence</i>					
Urban	193	34	17.6	0.611	0.552 – 1.392
Rural	107	22	20.6		

**Table 4:** Prevalence of dry eye in various occupational groups.

Occupation	Number of Subjects	Dry eye subjects	Prevalence (%)	p-value	95% CI
Farmers/ labourers	48	13	27.1	0.059	0.980 – 2.863
Others with high exposure	16	4	25.0	0.781	0.459 – 2.897
Housewives / students	123	25	20.3	0.341	0.783 – 1.979
Factory workers	5	1	20.0	0.714	0.088 – 6.183
Indoor office workers/ shopkeepers	53	7	13.2	0.132	0.310 – 1.192
Others with low exposure	55	7	12.7	0.079	0.287 – 1.098

**Table 5:** Multivariate logistic regression analysis showing strength of associations of various variables with dry eyes.

Variable	P-Value	Odd's Ratio	95% CI
<i>Occupation</i>			
a) Farmers / Labourers/ High Exposure Group	0.059	2.091	0.980 – 2.863
b) Indoor office workers/ shopkeepers	0.132	1.868	0.310 – 1.192
c) Other low exposure group	0.079	1.010	0.287 – 1.098
d) Housewives/ Students	0.015	1.942	1.139 – 3.229
Meibomian Gland Dysfunction	0.000	21.173	4.897 – 84.854
Diabetes	0.001	2.315	1.371 – 3.810
Smoking	0.139	1.44	0.452 – 1.249
Excessive Wind	0.005	2.12	0.263 – 0.791
Sunlight/High Temperature	0.012	1.94	0.309 – 0.872
Air pollution	0.291	1.34	0.389 – 1.340

## DISCUSSION

The main objectives of this study to determine the prevalence and risk factors of dry eyes were successfully met. Various studies have shown prevalence of dry eyes to vary from around 10% to 70% depending on the diagnostic criteria used and cut-off values for various tear film assessment tests<sup>8</sup>. Some studies performed tests only on those patients who had significant number of positive complaints about dry eyes resulting in higher prevalence of dry eyes<sup>9</sup>. Besides, some studies were carried out solely on patients with rheumatoid arthritis or Sjogren's syndrome who reported a high prevalence of dry eyes<sup>10-13</sup>. Our prevalence (18.7%) results fall within the

aforementioned range and are in accordance with results from various other studies.

Our results showed that the prevalence of dry eye increased as the age of the patients increased showing a direct relationship between age and dry eyes. This result was also consistent with many other studies<sup>14-17</sup>. A relative peak of dry eye prevalence was found in the age group 31-40 years as had earlier been observed by Hikichi et al<sup>18</sup>. We believe this age group suffers most from the occupational hazards due to maximum exposure to outdoor environmental risk factors leading to ocular dryness. Countries like Pakistan with plenty of sun exposure can exhibit this phenomenon to

a greater extent. However, we recommend more studies in this regard to find exact cause of this spike of prevalence of dry eyes in age group 31 – 40 years.

Like many other studies<sup>19</sup>, our study also showed significantly higher prevalence of dry eyes in females as compared to males (26.4% versus 16.1%;  $p = 0.021$ ). The higher prevalence of dry eyes in females implies that females seek medical attention earlier than males for their dry eye symptoms. Besides, menopause causes decreased estrogen level in females that lead to decreased tear film production in them<sup>20</sup>. We found out higher prevalence of dry eyes in post-menopausal women as compared to pre-menopausal women (30.1% versus 21.5%) which might be explained by the aforementioned normal physiological mechanism. Though our patients showed a higher prevalence of dry eyes in post-menopausal women, earlier studies have shown same prevalence of dry eyes in both pre- and post-menopausal women<sup>14</sup>. People residing in rural areas showed higher prevalence of dry eyes as compared to urban residents. But contrary to various other studies, the difference was not statistically significant. The higher prevalence in rural residents is thought to be the result of excessive exposure to sunlight and high outdoor temperatures<sup>21</sup>.

People belonging to various occupations like farmers/labourers, housewives; people with meibomian gland dysfunction, diabetics, and people with excessive exposure to sunlight, wind, cigarette smoking and air pollution were significantly related to dry eye. Khurana et al reported high prevalence of dry eyes in farmers and labourers (32% and 28% respectively) most likely due to increased exposure to hot temperatures and sunlight<sup>22,23</sup>. This necessitates urgent need to create awareness among farmers and labourers to take safety measures during their work. Many earlier studies have shown smoking, diabetes and pollution to be risk factors for dry eyes<sup>24</sup>. Smokers who suffer from dry eyes should be counseled about quitting or limiting smoking as a potential therapy for their dry eyes by reducing direct irritant effect of smoking on ocular surface.

Moss et al showed higher prevalence of dry eyes in patients with refractive errors as compared to emmetropes<sup>25</sup>. Our study also showed this relationship with refractive errors. These patients suffered more than emmetropes from dry eyes. Comparing emmetropes with refractive error group individuals, the prevalence of dry eyes was higher in both corrected and uncorrected refractive error group. However, subjects with their refractive errors

corrected suffered less in this condition as compared to those with uncorrected refractive error (16.3% versus 25.6%). This difference in patients with corrected and uncorrected refractive error was not statistically significant ( $p > 0.05$ ). It has been proposed that persons with refractive errors rub their eyes frequently leading to deposition of debris and infected particles in the fornices leading to instability of the tear film. Our study also showed that prevalence of dry eye was most in hypermetropes (18.9%) followed by myopes (16.2%) and emmetropes (15.2%). Incorporating refractive errors in dry eye researches has earlier been postulated in various studies<sup>25</sup>.

The main limitation of our study was exclusion of patients with various corneal and conjunctival pathologies which led to a relative apparent underestimation of prevalence of dry eyes in our sample. Besides, participants using contact lenses were also excluded who could have been a potential source of the condition. Fluorescein dye was used to carry out tear film break up time which itself was irritating and could cause reflex tearing. So, newer studies may use non-invasive and non-contact techniques of measuring tear breakup time. Further studies may be conducted to establish a uniform criterion for diagnosis and more etiologic associations of dry eyes. This raises the need to gather more data on the subject from our country.

## CONCLUSION

Dry eye is quite prevalent in our cohort of patients who were suffering from ocular disease other than gross corneal and conjunctival pathologies. The study reflects a major but underdiagnosed burden of the condition in our out-patient departments. We conclude that dry eye is associated with increasing age, female gender, outdoor occupations, smoking, diabetes, meibomian gland dysfunction and refractive errors. The results should guide ophthalmic community in developing more targeted and focused approaches towards management of this issue since dry is not only an ocular disease but also a great burden on the economics of the patient. Detailed history about symptoms of the condition and good clinical examination with tear film break up time can help us properly diagnose and manage this condition actively.

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