Original Article

Prevalence and Factors Associated with Dry Eye Disease in Adult Patients in National Eye Center, Kaduna Nigeria

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Abstract

Background: The purpose of this study is to assess the prevalence and factors associated with dry eye disease (DES) in adult patients with a view to improving the diagnosis and management. **Patients, Materials and Methods:** Two hundred and sixty-six (266) adults were enrolled into the study. Ocular surface disease index (OSDI) scores, tear film break up time (TBUT) test, Schirmer's test, and epithelial staining with fluorescein were performed on all the participants. Comprehensive analysis of data using IBM SPSS version 23 was done. Statistical significance was set at $P < 0.05$. **Results:** Two hundred and sixty-six participants were examined. The sample mean age was 44.75 years ± 14.38 standard deviation Dry eye prevalence in the sample was 45.9% (95% confidence interval: 39%–52%), the prevalence was 62% by the OSDI, 54.1% by TBUT test, 30.5% by Schirmer's test while 70.3% of the participants had abnormal fluorescein corneal staining. Significant risk factors contributing to dry eye prevalence among the participants were age, gender, and educational status. **Conclusion:** DES is common in our environment and efforts should always be made to identify patients with dry eye syndromes and treat appropriately.

Keywords: Dry eye, meibomaim gland, tear film

Introduction

Dry eye disease (DES) results from loss of homeostasis of the tear film causing discomfort, abnormalities of vision, ocular surface inflammation, and instability of the tear film potentially damaging the ocular surface.[1,2]

Tear film stability is disrupted when the relationship between the stabilizing tear film constituents is compromised by reduced tear secretion, delayed clearance, or altered composition.[3,4]

Dry eye has been associated with the following: female gender, older age groups,[5] connective tissue disease such as arthritis, postmenopausal women, estrogen therapy,[5,6] and drugs such as antihistamines, diuretics, beta-blockers, and antidepressants.[5,6]

The relative frequency of dry eye varies from 5% to 30% in persons aged 50 years and older.[3] This may be partly due to the different methodologies used by researchers and various tests used for diagnosis.[3]

Few studies have evaluated dry eyes and the factors associated with risk of developing dry eye in Nigeria, and even fewer studies have been conducted in Northern Nigeria.[7-9]

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This study aims to assess the prevalence and the factors associated with DES among Nigerian patients.

Patients' Materials and Methods

Study design

This cross-sectional study based in a hospital setting was carried out between June and September 2018.

Study population

All adult patients aged 18 years and older who visited the outpatient eye clinic within the study period and gave written informed consent were recruited for the study.

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Study criteria

The inclusion criteria included participants aged 18 years and older who visited the outpatient eye clinic within the study period and gave written informed consent.

The exclusion criteria included ocular conditions that could alter tear secretion or stability like blepharitis, pterygium, previous trauma or ocular surgery, thermal or chemical burns, use of topical beta-blockers and anaesthetic agents, systemic medications such as antihistamines and diuretics. Systemic diseases included Sjogren syndrome, collagen vascular diseases, and rheumatoid arthritis.

A sample size of 266 was calculated, using semi-structured pretested interviewer administered questionnaires, information about age, sex, occupation, and educational level of the participants were collected. Detailed ocular examination was done on all participants by a single ophthalmologist who also did the Tear film break up time (TBUT), ocular surface staining, Schirmer test 1, and used the ocular surface disease index (OSDI) questionnaire to assess if dry eye is present in the participants.

Schirmer test I was carried out to measure maximum basic and reflex tear volume. The eye was gently dried, the lower conjunctiva adequately exposed and a 5 mm by 35 mm filter paper was placed between the middle and outer third of the lower eyelid after folding it at 5 mm from one end. The subject then closed the eyes for 5 min and the degree of filter paper wetting was recorded in millimeters using the markings on the strip. A value of <10 mm was considered abnormal.

Tear film break-up time

The patient was positioned at the slit lamp and a fluorescein impregnated strip was placed at the inferior temporal bulbar conjunctiva of the eye. After three blinks, the patient was asked to look straight ahead without blinking. Using a cobalt-blue filter and broad beam of light from the slit lamp, the surface of the cornea was examined for the appearance of dark spots or streaks.[7] The time from the last blink to the appearance of the first dark spot was recorded in seconds to determine the TBUT.[7] Three consecutive readings were taken and an average value determined. A TBUT of <10 s was taken as abnormal. For any patient already on tear substitutes, the test was carried out after the patient has stopped the medication for at least 24 h.

Ocular surface fluorescein staining: this was done to assess the protective status of the precorneal tear film and integrity of the surface epithelium of the cornea. Each eye was stained with fluorescein and graded under the slit lamp as follows:

Grade 0 – no staining, Grade 1 – mild,[10] limited to <1/3 cornea, Grade 2 – moderate, 1/3 to <1/2 cornea, and Grade 3 – severe, >1/2 cornea. Fluorescein staining of at least Grade 1 was regarded abnormal.[10]

Data analysis

Data were collected on standardized forms following strict regulations to ensure data confidentiality. Comprehensive statistical analysis was carried out using IBM SPSS VERSION 23 (International Business Machines, New York city, USA, Statistical Package for Social Sciences version 23). The Chi-square test and logistic regression were used to evaluate the factors associated with increased risk of dry eyes. Confidence interval (CI) of 95% was calculated, and statistical significance was set at $P < 0.05$.

Ethics and consent

The Health Research Ethics committee of our institution granted approval to conduct the study and the study followed the rules and regulations regarding studies using human subjects as outlined by the Helsinki declaration. All recruited patients gave written informed consent.

Results

Two hundred and sixty-six participants completed the study. Mean age was 44.75 years+/–14.38 standard deviation, whereas the mean age group lies between 36 and 45 years. Females accounted for 138 (51.9%) of the participants [Table 1].

Most of the participants were traders 71 (26.7%), followed by civil servants 70 (26.3%), students 47 (17.7%), farmers 26 (9.8%), homemakers 20 (7.5%), retirees 17 (6.4%), and Artisans 15 (5.6%). The observed differences in the occupation of the participants were statistically significant ($P = 0.001$).

Majority of the studied subjects had tertiary education 148 (55.6%), followed by secondary education 47 (17.7%) and primary education 31 (11.7%). There were 40 (15.0%) of the studied participants with no formal education. The observed difference in the educational status of the subjects was not statistically significant ($P = 0.629$).

The crude prevalence of DES was 45.9% (95% CI 39% – 52%) and was 62.0%, 54.1%, and 30.4% using the OSDI questionnaire, tear break up time and Schirmer Test, respectively [Table 2].

Logistic regression model for the factors associated with increased risk of abnormal OSDI scores revealed that age ($P = 0.038$), gender ($P = 0.038$), educational status ($P = 0.001$), and systemic drug history ($P = 0.02$) were significantly associated with abnormal OSDI score [Table 3].

Table 1: Distribution of age by gender of participants

Age group	Gender		Total
	Female, *n* (%)	Male, *n* (%)	
18-25	29 (10.9)	19 (7.1)	48 (18)
26-35	16 (6)	19 (7.1)	35 (13.2)
36-45	46 (17.3)	33 (12.4)	79 (29.7)
46-55	16 (6)	28 (10.5)	44 (16.5)
56-65	22 (8.3)	21 (7.9)	43 (16.2)
>65	9 (3.4)	8 (3)	17 (6.4)
Total	138 (51.9)	128 (48.1)	266 (100)

Logistic regression model for the factors associated with increased risk of abnormal TBUT revealed that no factor was associated with abnormal TBUT [Table 4].

Logistic regression model for the factors associated with increased risk of abnormal schirmer test revealed that that no factors were significantly associated with abnormal Schirmer test [Table 5].

Discussion

The study sort to find the prevalence of dry eye in patients at endocrinology and ophthalmic outpatient clinic and the factors associated with the condition. Majority of the participants were female (51.9%), similar to what was obtained in the study by Onwubiko *et al*. in South-Eastern Nigeria where females accounted for 57.9% of the participants.[7] This may suggest that women easily consented to participate in the study.

In this study, traders formed a greater percentage of participants (26.7%) followed by civil servants (26.3%), similar to what was obtained in the study by Shah and Jani where majority had outdoor occupation.[11] In the study by Onwuibiko *et al*., a greater percentage (33.6%) of participants were civil servants engaged in indoor occupations.[7] People exposed to harsh weather such as intense sunlight and dust are likely to develop ocular symptoms and eventually present to the hospital.

In this study, majority of the participants had tertiary education and were married similar to what was obtained in the study by Onwuibiko *et al*. in where the participants also had formal education and were married.[7] Educational statuses could suggest a decreased blink rate from prolonged visual tasks during reading of books or use of visual display terminal.

Table 2: Total prevalence and prevalence by type of test

	Prevalence, *n* (%)	95% CI
OSDI	165 (60.0)	56-68
TBUT	144 (54.1)	48-60
Schirmers test	81 (30.5)	25-36
Crude	122 (45.9)	39-52

CI: Confidence interval, OSDI: Ocular surface disease index, TBUT: Tear film break up time

Table 3: Logistic regression ocular surface disease index

	B	SE	Wald	Df	Significance	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Step 1[a]								
Age	−0.300	0.144	4.314	1	0.038	0.741	0.558	0.983
Gender	0.608	0.293	4.322	1	0.038	1.837	1.035	3.259
Marital status	0.265	0.377	0.493	1	0.483	1.303	0.622	2.729
Education status	−0.678	0.180	14.235	1	0.000	0.508	0.357	0.722
Occupation	0.121	0.079	2.353	1	0.125	1.129	0.967	1.318
Residence	−0.244	0.524	0.216	1	0.642	0.784	0.281	2.190
Systemic Hx	0.022	0.270	0.007	1	0.934	1.023	0.603	1.734
Social Hx	−0.061	0.148	0.171	1	0.679	0.941	0.703	1.258
Systemic drug	0.764	0.341	5.012	1	0.025	2.146	1.100	4.188
Constant	1.960	1.311	2.234	1	0.135	7.097		

Nagelkerke R^2=23.8%. B: Regression coefficient, SE: Standard error, Wald: Wald statistic, EXP (B): Odds ratio for each variable category, Df: Degree of freedom, Significance: *P* value for each variable category, CI: Confidence interval for each variable, *P Significant at <0.05

Table 4: Logistic regression tear film break up time

	B	SE	Wald	Df	Significance	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Step 1[a]								
Age	−0.083	0.124	0.447	1	0.504	0.921	0.722	1.173
Gender	0.087	0.270	0.104	1	0.747	1.091	0.642	1.853
Marital status	−0.596	0.338	3.102	1	0.078	0.551	0.284	1.070
Education status	−0.016	0.141	0.012	1	0.912	0.984	0.746	1.298
Occupation	−0.034	0.070	0.240	1	0.624	0.966	0.843	1.108
Residence	0.497	0.428	1.352	1	0.245	1.644	0.711	3.802
Past systemic Hx	−0.165	0.206	0.644	1	0.422	0.847	0.566	1.270
Social Hx	0.137	0.143	0.923	1	0.337	1.147	0.867	1.519
Systemic drug	−0.054	0.195	0.075	1	0.784	0.948	0.647	1.389
Constant	0.554	1.137	0.237	1	0.626	1.739		

Nagelkerke R^2=69%. B: Regression coefficient, SE: Standard error, Wald: Wald statistic, EXP (B): Odds ratio for each variable category, Df: Degree of freedom, Significance: *P* value for each variable category, CI: Confidence interval for each variable, *P Significant at <0.05

Table 5: Logistic regression schirmers

	B	SE	Wald	Df	Significance	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Step 1[a]								
Age	−0.236	0.134	3.118	1	0.077	0.790	0.607	1.026
Gender	−0.106	0.298	0.126	1	0.723	0.900	0.501	1.614
Marital status	0.064	0.362	0.031	1	0.861	1.066	0.524	2.167
Education status	0.110	0.146	0.571	1	0.450	1.116	0.839	1.486
Occupation	−0.019	0.073	0.065	1	0.799	0.982	0.850	1.133
Residence	0.143	0.444	0.103	1	0.748	1.154	0.483	2.755
Past systemic Hx	−0.129	0.202	0.406	1	0.524	0.879	0.592	1.306
Social Hx	0.173	0.148	1.359	1	0.244	1.189	0.889	1.590
Systemic drug	−0.112	0.194	0.332	1	0.564	0.894	0.611	1.308
Constant	0.875	1.169	0.560	1	0.454	2.399		

B: Regression coefficient, SE: Standard error, Wald: Wald statistic, EXP (B): Odds ratio for each variable category, Df: Degree of freedom, Significance: *P* value for each variable category, CI: Confidence interval for each variable, *P Significant at <0.05

The prevalence of dry eye using the OSDI questionnaire was 62% in this study. Mostafa observed a dry eye prevalence of 55% by OSDI in Southern Egypt.[12] The similar results with Mostafa and this study is most likely due to climatic similarities between Northern Nigeria and Egypt of dry arid environs. Onwuibiko *et al*. in South Eastern Nigeria observed 19.2% prevalence, using OSDI.[7] The difference observed between this study and the study by Onwuibiko *et al*. in South Eastern Nigeria may be because Kaduna state in North Western Nigeria has a dry and dusty climate which predisposes to frequent irritating ocular symptoms that may result from, or lead to dry eye. The high prevalence in this study can also be explained by a higher number of participants being traders who spend more periods of the day outdoor.

The prevalence of dry eyes by Schirmer's test was 30.45% in this study. In the study by Onwuibiko *et al*., it was 42.3%,[7] while Mostafa had a prevalence of 39.3%.[12] The result in this study is high and may suggest high lacrimal gland insufficiency among participants. Further investigation of such patients may reveal likely primary causes of lacrimal disease among the participants.

Dry eye prevalence by TBUT was 54.1% in this study similar to what was obtained in the study by Onwubiko *et al*. of 50.5%[7] and Mostafa with a prevalence of 44.7%.[12] Tear break up reflects the integrity of the lipid tear layer which is a function of the meibomian glands. This value obtained suggests that a large proportion of people presenting with dry eye symptoms may have meibomian gland abnormalities.

The overall prevalence of dry eyes after subjective and objective assessment was 45.9%, these findings appear similar to what was obtained by Ranjan *et al*. in a tertiary center in India with a prevalence of 45.39%,[13] and Asiedu *et al*. with a prevalence of 44.3% among undergraduates in Ghana.[14] although Kobia-Acquah *et al*. also in Ghana found a much higher prevalence of 69%,[15] the higher prevalence could be because the study had a large number of older subjects and had different criteria for the diagnosis. Prevalence rates for dry eye vary from region to region, especially from hospital-based studies. Several studies have found much lower prevalence. Mostafa reported a lower prevalence after subjective and objective assessment of 22.8% in individuals 18 years and above.[12] Gong *et al*. also had 27.8%,[16] while Caffery *et al*. in a Canada found a prevalence of 22% in participants 18 years and older.[17] In South-East Nigeria, Onwuibiko *et al*. had a prevalence of 19.5% using the questionnaire for subjective assessment only.[7] In China, Chen *et al*. revealed a prevalence of 9.54% and 7.99% in persons 20 years and above based on subjective and objective assessment, respectively.[18] These differences in the prevalence obtained in many of the studies outlined above could be explained by geographic location, individuals in arid winding and dusty regions are more prone to dry eyes. Secondly, it has been generally noted that higher prevalence is encountered in hospital studies, this is likely because of the smaller sample sizes when compared with the very large population based studies, also individuals engaged in outdoor occupations are more exposed to effects of environmental factors. Finally, the case definition for dry eye varied in these hospital studies depending on whether only subjective tests were done or they were combined with objective tests.

DES was more common among females compared to males using either the OSDI questionnaire, Schirmers or Tear break-up tests in this study similar to the findings of several studies where females were found to have more dry eyes than males.[4,15-18] Females are more affected possibly because they have hormonal changes in pregnancy, menopause, and from use of contraceptives.

This study revealed that age, gender (females), and educational status (tertiary education) were associated with DES using the OSDI score. This could be due to the fact that increasing use visual display terminals reduces blinking during visual activities and exposure to low humidity in offices which may likely be air conditioned, predisposes the more educated persons to DES. However, Onwubiko *et al*. found DES to be more in patients with no formal education.[7] This could be

explained by the fact that the researchers used questionnaires for subjective assessment only and may have been difficult for those without formal education to comprehend.

The study was hospital based hence limited to people who presented themselves with symptoms that required an ophthalmic review. The tear osmolarity test which has a high sensitivity and specificity using an osmometer would have given the best picture on the disease prevalence, its unavailability limited the study.

Conclusion

The study has shown that dry eye occurs in our environment and a high index of suspicion is required while evaluating ophthalmic patients, especially those with symptoms suggestive of DES.

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Conflicts of interest

There are no conflicts of interest.

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