THE PLANET

Original Article

Correlation between serum vitamin A level and tear film Abnormalities in dry eye patients

Sanwar Hossain[1], Mohammad Mazaharul Islam[2*], Arifuzzaman[3], Mukter Ali[4], Golam Faruk Hossain[5]

ARTICLE INFO

Received: 12 May 2026
Accepted: 26 May 2026
Published Online: 8 June 2026

DOI: 10.5281/zenodo.20586233

Volume: 9, Number: 4, Page: 9-12

e-ISSN: 2789-5912
ISSN: 2617-0817

*Corresponding author

ABSTRACT

Background: Dry eye disease is a common ocular surface disorder associated with tear film instability and ocular discomfort. Vitamin A plays an important role in maintaining ocular surface integrity and tear film function. This study aimed to evaluate the correlation between serum vitamin A levels and tear film abnormalities among patients with dry eye disease. **Methods & Materials:** This cross-sectional observational study was conducted in the Department of Ophthalmology of Dr. Sirajul Islam Medical College and Bangladesh Medical University from January 2025 to December 2025. A total of 80 clinically diagnosed dry eye patients were enrolled purposively. Serum vitamin A levels were measured, and tear film abnormalities were assessed by Schirmer test, Tear Break-Up Time (TBUT), corneal staining, and conjunctival xerosis. Data were analyzed using SPSS version 25. **Results:** The mean age of the patients was 42.6 ± 11.4 years, and females constituted 63.8% of cases. Mean serum vitamin A level was 24.8 ± 7.1 µg/dL. Vitamin A deficiency was observed in 33.7% patients, while 38.8% had borderline levels. Moderate dryness on Schirmer test was present in 45.0% patients and TBUT of 5–10 seconds in 47.5% cases. Patients with severe dryness had significantly lower serum vitamin A levels (18.9 ± 5.3 µg/dL) compared to mild/normal cases (32.1 ± 6.2 µg/dL) ($p<0.001$). **Conclusion:** Lower serum vitamin A levels were significantly associated with increased severity of tear film abnormalities in dry eye disease.

Keywords: *Dry eye disease, Vitamin A, Tear film abnormalities, Schirmer test, TBUT, Ocular surface.*

1. *Assistant Professor, Department of Ophthalmology, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0000-0003-3605-1507)*
2. *Associate Professor, Department of Community Ophthalmology, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0009-0002-0014-1797)*
3. *Assistant Professor, Department of Ophthalmology, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0009-0003-8555-1388)*
4. *Assistant Professor, Department of Ophthalmology, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0009-0007-6026-9588)*
5. *Associate Professor, Department of Community Ophthalmology, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0009-0008-5914-3344)*

INTRODUCTION

Dry eye disease is a common multifactorial disorder of the ocular surface characterized by inadequate tear production or excessive tear evaporation, leading to instability of the tear film and ocular discomfort [1]. It is one of the most frequently encountered ophthalmic conditions worldwide and significantly affects quality of life by causing irritation, burning sensation, redness, foreign body sensation, photophobia, and fluctuating vision [2]. The prevalence of dry eye disease has been increasing due to aging, environmental pollution, excessive digital screen exposure, nutritional deficiencies, and systemic illnesses. In developing countries, dry eye disease is increasingly recognized as an important public health concern because of poor nutritional status, environmental dust exposure, and limited awareness regarding ocular health [3].

Vitamin A is a fat-soluble vitamin that plays a crucial role in maintaining the integrity and function of epithelial tissues, including the conjunctival and corneal epithelium [4]. It is essential for normal differentiation of goblet cells and maintenance of the mucin layer of the tear film. Deficiency of vitamin A can lead to ocular surface keratinization, goblet cell loss, conjunctival xerosis, corneal dryness, and tear film instability [5]. Severe vitamin A deficiency may progress to xerophthalmia and corneal ulceration, which remain important causes of preventable blindness in developing countries [6].

Several studies have suggested that low serum vitamin A levels may contribute to the development and severity of dry eye disease through impairment of tear secretion and alteration of the ocular surface [7]. Tear film abnormalities such as reduced Tear Break-Up Time (TBUT), decreased Schirmer test values, and positive corneal staining have been found to correlate with nutritional deficiencies, particularly vitamin A deficiency [8]. However, evidence regarding the relationship between serum vitamin A levels and tear film abnormalities among dry eye patients in the Bangladeshi population remains limited.

Assessment of serum vitamin A levels in patients with dry eye disease may provide valuable information regarding the nutritional and pathological factors associated with ocular surface dysfunction. Early identification of vitamin A deficiency could help in improving treatment strategies and preventing progression of ocular complications. Therefore, this study was undertaken to evaluate the correlation between serum vitamin A levels and tear film abnormalities among patients with dry eye disease attending the Department of Ophthalmology of Dr. Sirajul Islam Medical College and Bangladesh Medical University.

METHODS & MATERIALS

This cross-sectional observational study was conducted in the Department of Ophthalmology of Dr. Sirajul Islam Medical College and Bangladesh Medical University from January 2025 to December 2025. A total of 80 patients diagnosed clinically with dry eye disease were enrolled purposively during the study period. Adult patients of both sexes aged above 18 years presenting with symptoms suggestive of dry eye, including ocular irritation, burning sensation, foreign body sensation, redness, and visual discomfort, were included in the study. Diagnosis of dry eye was confirmed by detailed ophthalmic examination, Schirmer test,

Tear Break-Up Time (TBUT), and ocular surface evaluation.

Patients with active ocular infection, ocular trauma, previous ocular surgery within the last six months, contact lens users, patients receiving vitamin A supplementation, and those with systemic diseases affecting tear secretion such as Sjögren syndrome, uncontrolled diabetes mellitus, or autoimmune disorders were excluded from the study. After obtaining informed written consent, venous blood samples were collected from all participants for estimation of serum vitamin A levels. Tear film abnormalities were assessed by Schirmer test values, TBUT measurements, and corneal staining findings.

All collected data were recorded in a predesigned structured questionnaire. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as frequency and percentage. Pearson correlation test and chi-square test were applied to assess the association between serum vitamin A level and tear film abnormalities. A p value of less than 0.05 was considered statistically significant.

RESULTS

Table I shows the socio-demographic characteristics of the 80 study patients with dry eye disease. The mean age of the patients was 42.6 ± 11.4 years, and the highest proportion of patients, 23 (28.7%), belonged to the 41–50 years age group. Female patients were predominant comprising 51 (63.8%) cases, while males constituted 29 (36.2%) cases. Most of the participants were from urban areas, accounting for 47 (58.7%) patients. Regarding occupation, homemakers formed the largest group with 28 (35.0%) patients followed by service holders in 17 (21.3%) cases.

Table I

Socio-demographic Characteristics of the Study Patients (*n*=80)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
18–30	21	26.3
31–40	19	23.8
41–50	23	28.7
>50	17	21.2
Mean age ± SD	42.6 ± 11.4 years	
Gender		
Male	29	36.2
Female	51	63.8
Residence		
Urban	47	58.7
Rural	33	41.3
Occupation		
Homemaker	28	35
Service holder	17	21.3
Farmer	9	11.2
Business	11	13.8
Student	7	8.7
Others	8	10.0

Table II demonstrates the distribution of serum vitamin A levels among the study patients with dry eye disease. The mean serum vitamin A level was 24.8 ± 7.1 µg/dL. Borderline serum vitamin A levels (20–30 µg/dL) were observed in the majority of patients, accounting for 31 (38.8%) cases, while 27 (33.7%) patients had deficient vitamin A levels below 20 µg/dL. Normal serum vitamin A levels were found in 22 (27.5%) patients.

Table II

Distribution of Serum Vitamin A Levels Among Dry Eye Patients (*n*=80).

Serum Vitamin A Level	Frequency (n)	Percentage (%)
Deficient (<20 µg/dL)	27	33.7
Borderline (20–30 µg/dL)	31	38.8
Normal (>30 µg/dL)	22	27.5
Mean serum vitamin A level ± SD	24.8 ± 7.1 µg/dL	

Table III illustrates the tear film abnormalities among the study patients with dry eye disease. Moderate dryness on Schirmer test (5–10 mm) was the most common finding observed in 36 (45.0%) patients, while severe dryness (<5 mm) was present in 24 (30.0%) cases. Regarding Tear Break-Up Time (TBUT), 38 (47.5%) patients had values between 5–10 seconds and 26 (32.5%) patients had TBUT less than 5 seconds. Corneal staining positivity was detected in 29 (36.3%) patients, whereas conjunctival xerosis was present in 18 (22.5%) cases.

Table III
Tear Film Abnormalities Among the Study Patients (*n*=80).

Tear Film Parameters	Frequency (n)	Percentage (%)
Schirmer Test		
Severe dryness (<5 mm)	24	30.0
Moderate dryness (5–10 mm)	36	45.0
Mild/normal (>10 mm)	20	25.0
TBUT (seconds)		
<5 sec	26	32.5
5–10 sec	38	47.5
>10 sec	16	20.0
Corneal staining positive	29	36.3
Conjunctival xerosis present	18	22.5

Table IV presents the correlation between serum vitamin A levels and tear film abnormalities among the study patients with dry eye disease. A clear trend was observed where lower serum vitamin A levels were associated with more severe tear film dysfunction. Patients with severe dryness on Schirmer test (<5 mm) had a lower mean vitamin A level of 18.9 ± 5.3 µg/dL compared to 24.7 ± 4.9 µg/dL in moderate dryness and 32.1 ± 6.2 µg/dL in mild/normal cases, with a statistically significant difference ($p < 0.001$). Similarly, TBUT values showed a significant positive association with serum vitamin A levels, with the lowest level in patients having TBUT <5 seconds (19.6 ± 5.7 µg/dL) and the highest in those with TBUT >10 seconds (33.4 ± 5.8 µg/dL) ($p < 0.001$). Corneal staining positivity was also associated with significantly lower serum vitamin A levels (20.8 ± 5.6 µg/dL) compared to staining-negative patients (27.9 ± 6.3 µg/dL), with a significant p value of 0.002.

Table IV
Correlation Between Serum Vitamin A Level and Tear Film Abnormalities (*n*=80).

Variables	Mean Serum Vitamin A Level (µg/dL)	p value
Severe dryness (<5 mm Schirmer)	18.9 ± 5.3	<0.001
Moderate dryness (5–10 mm)	24.7 ± 4.9	
Mild/normal (>10 mm)	32.1 ± 6.2	
TBUT <5 sec	19.6 ± 5.7	<0.001
TBUT 5–10 sec	25.1 ± 5.2	
TBUT >10 sec	33.4 ± 5.8	
Corneal staining positive	20.8 ± 5.6	0.002
Corneal staining negative	27.9 ± 6.3	

DISCUSSION

The present study evaluated the correlation between serum vitamin A levels and tear film abnormalities among patients with dry eye disease. In this study, the mean age of the patients was 42.6 ± 11.4 years, with the highest proportion belonging to the 41–50 years age group (28.7%). Female predominance was observed, accounting for 63.8% of the cases. Similar female predominance in dry eye disease has been reported by Jain et al. and Kim et al., who noted that hormonal influences, nutritional imbalance, and environmental exposure contribute significantly to ocular surface dysfunction among middle-aged women [9,10].

The present study demonstrated that a considerable proportion of patients had low serum vitamin A levels. Deficient serum vitamin A levels (<20 µg/dL) were found in 33.7% patients, while 38.8% had borderline levels, with a mean serum vitamin A level of 24.8 ± 7.1 µg/dL. These findings support the growing evidence that nutritional deficiencies are closely associated with dry eye disease. Bhandarkar et al., emphasized the importance of nutritional status in maintaining tear film integrity and ocular surface health, highlighting the role of micronutrients including vitamin A in dry eye pathogenesis [11]. Similarly, Huang et al., reported that nutritional supplementation improved tear secretion and reduced ocular surface inflammation in patients with dry eye syndrome [12].

Regarding tear film abnormalities, moderate dryness on Schirmer test was observed in 45.0% of patients, while severe dryness was present in 30.0% cases. TBUT between 5–10 seconds was observed in 47.5% patients and TBUT less than 5 seconds in 32.5% cases. Corneal staining positivity was found in 36.3% patients. These findings indicate substantial tear film instability and ocular surface compromise among dry eye patients. Similar observations were reported by Bhujbal et al., who described chronic ocular surface inflammation and tear instability as key mechanisms in dry eye disease progression [13]. Fineide et al., also demonstrated significant metabolic alterations in tear composition among females with evaporative dry eye disease, suggesting a strong biochemical basis for tear film dysfunction [14].

A significant association was observed between serum vitamin A levels and severity of tear film abnormalities in the present study. Patients with severe dryness on Schirmer test had markedly lower serum vitamin A levels (18.9 ± 5.3 µg/dL) compared to patients with mild or normal tear secretion (32.1 ± 6.2 µg/dL), which was statistically significant ($p <0.001$). Likewise, patients with TBUT less than 5 seconds had lower vitamin A levels (19.6 ± 5.7 µg/dL) compared to those with TBUT greater than 10 seconds (33.4 ± 5.8 µg/dL). These findings suggest that reduced vitamin A levels are strongly associated with deterioration of tear film stability and ocular surface health.

Comparable findings were reported by Jadeja and Ganasava, who found improvement in tear film stability and clinical dry eye parameters following short-term oral vitamin A supplementation [15]. Their study supports the essential role of vitamin A in maintaining conjunctival goblet cell function and tear film quality. Similarly, Aydemir et al. demonstrated that nutritional deficiencies adversely affect tear meniscus parameters and ocular surface function [16]. Jain et al. and Sajj et

al. also reported associations between vitamin deficiencies and dry eye syndrome, suggesting that systemic nutritional status may significantly influence ocular surface disorders [9,17].

Corneal staining positivity in the current study was associated with significantly lower serum vitamin A levels (20.8 ± 5.6 µg/dL) compared to staining-negative patients (27.9 ± 6.3 µg/dL) (p=0.002). This finding reflects the role of vitamin A in epithelial integrity and ocular surface protection. Previous studies by Kang et al. and He et al., demonstrated improvement of ocular surface epithelial healing with serum-based therapies in severe dry eye disease, further supporting the importance of nutritional and biochemical factors in ocular surface maintenance [18,19].

LIMITATIONS

This study was conducted in two tertiary care hospitals with a relatively small sample size of 80 patients, which may limit the generalizability of the findings to the broader population. In addition, the cross-sectional study design could identify associations between serum vitamin A levels and tear film abnormalities but could not establish a definite causal relationship.

CONCLUSION

The present study demonstrated a significant association between lower serum vitamin A levels and increased severity of tear film abnormalities among patients with dry eye disease. Patients with deficient or borderline vitamin A levels showed poorer Schirmer test values, reduced Tear Break-Up Time, and greater ocular surface abnormalities. These findings suggest that assessment of serum vitamin A status may play an important role in the evaluation and management of dry eye disease, and early nutritional intervention could help improve ocular surface health and tear film stability.

FUNDING

No funding sources.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Çalık Başaran N, Kırağı D, Tan Ç, Özışık L, Çağdaş Ayvaz ND, Kocabeyoğlu S, Öz ŞG, İrkeç M, Tezcan Fİ. Ocular Changes and Tear Cytokines in Individuals with Low Serum Vitamin D Levels: A Cross-Sectional, Controlled Study. Ocular Immunology and Inflammation. 2024 Mar 15;32(3):287-94.
2. Jasim DN, Abdul-Nabi MA, Fadil AM. The correlation between vitamin D deficiency with tear film break-up time in patients with dry eye syndrome. Romanian Journal of Diabetes Nutrition and Metabolic Diseases. 2023 Dec 31;30(4):414-23.
3. Bhatt RB, Patel NH, Shah AT, Ranpara KH. Study of correlation between vitamin D3 levels and dry eye. Indian Journal of Ophthalmology. 2023 Apr 1;71(4):1478-82.
4. Hyon JY, Han SB. Dry eye disease and vitamins: a narrative literature review. Applied Sciences. 2022 Apr 30;12(9):4567.
5. Gürbostan Soysal G, Seyyar SA, Mercanlı M, Caran Karabacak E. The effect of vitamin D insufficiency on tear meniscus parameters in patients without symptomatic dry eye. Clinical and Experimental Optometry. 2025 Nov 19:1-9.
6. Najjaran M, Zarei-Ghanavati S, Arjmand Askari E, Eslampoor A, Ziaei M. Effect of oral vitamin D supplementation on dry eye disease patients with vitamin D deficiency. Clinical and Experimental Optometry. 2023 Apr 3;106(3):257-62.
7. Rolando M, Barabino S. Dry eye disease: what is the role of vitamin D?. International Journal of Molecular Sciences. 2023 Jan 11;24(2):1458.
8. Fatima S, Malik SM, Akbar B, Mirza R. Role Of Vitamin D3 Supplementation in Dry Eye Disease. Ophthalmology Pakistan. 2025 Nov 26;15(3):89-95.
9. Jain N, Sharma P, Chouhan JK. A study of the association between Vitamin D deficiency and Dry Eye Syndrome (DES) in the Indian population. Indian Journal of Ophthalmology. 2022 Feb 1;70(2):500-4.
10. Kim JM, Choi YJ. Impact of dietary nutrients on the prevalence of dry eye syndrome among Korean women aged 40 and above: evidence from the Korea National Health and Nutrition Examination Survey. Nutrients. 2024 Jan 26;16(3):372.
11. Bhandarkar NS, Shetty K, Narendra P, Kiran A, Shetty R, Shetty KB. Nutrition and diet for dry eye disease: Insights toward holistic management. Indian Journal of Ophthalmology. 2024 Oct 1;72(10):1412-23.
12. Huang SC, Lei YP, Hsiao MC, Hsieh YK, Tang QP, Chen C, Hsu MY. Multicomponent dietary supplementation: impact on tear secretion and ocular surface inflammation in dry eye syndrome patients. Antioxidants. 2025 Jan 16;14(1):103.
13. Bhujbal S, Rupenthal ID, Steven P, Agarwal P. Inflammation in Dry Eye Disease—Pathogenesis, Preclinical Animal Models, and Treatments. Journal of Ocular Pharmacology and Therapeutics. 2024 Dec 1;40(10):638-58.
14. Fineide FA, Tashbayev B, Elgstøen KB, Sandås EM, Rootwelt H, Hynne H, Chen X, Ræder S, Vehof J, Dartt D, Jensen JL. Tear and saliva metabolomics in evaporative dry eye disease in females. Metabolites. 2023 Nov 2;13(11):1125.
15. Jadeja JN, Ganasava SL. Effect of Short-Term Oral Vitamin A Supplementation on Tear Film Stability, Tear Ferning Patterns, and Clinical Parameters in Dry Eye Disease. International Journal of Medical Research. 2024 Jan 1;12(01):11-7.
16. Aydemir GA, Aydemir E, Asik A. Changes in tear meniscus analysis of children who have type 1 diabetes mellitus, with and without vitamin D deficiency. Cornea. 2022 Nov 1;41(11):1412-7.
17. Sajj AB, Islam MA, Sharmin T, Ahmed MS, Kabir MS. Vitamin D Status Among Patients With Dry Eye Syndrome Attended In Bangabandhu Sheikh Mujib Medical University (BSMMU). The Journal of Ad-din Women's Medical College. 2023 Jul 10;11(2):3-8.
18. Kang MJ, Lee JH, Hwang J, Chung SH. Efficacy and safety of platelet-rich plasma and autologous-serum eye drops for dry eye in primary Sjögren's syndrome: A randomized trial. Scientific Reports. 2023 Nov 7;13(1):19279.
19. He CZ, Zeng ZJ, Liu JQ, Qiu Q, He Y. Autologous serum eye drops for patients with dry eye disease: a systematic review and meta-analysis of randomized controlled trials. Frontiers in medicine. 2024 Sep 13;11:1430785.