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Assessment of Awareness of Dry Eye in Youth and its Association with Extended Screen Time Use in Saudi Arabia

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Abstract

BACKGROUND: Dry eye disease (DED) is a multifactorial condition characterized by discomfort and visual disturbances, often linked to prolonged screen time and other environmental or lifestyle factors. In Saudi Arabia, DED prevalence is increasing, especially among younger populations.

AIM: This study aimed to assess the prevalence of DED, its associated risk factors, and awareness among Saudi youth.

METHODOLOGY: A cross-sectional questionnaire-based study was conducted targeting 366 Saudi youth. The sample was recruited randomly, with the majority (89.3%) from the central region. Participants ranged in age from 19 to over 55 years, with a mean age of 28.6 ± 11.7 years. Data were collected via a self-administered electronic questionnaire covering demographics, screen time, awareness, and risk factors related to DED. The Ocular Surface Disease Index (OSDI) was used to assess the severity of DED. Statistical analysis was performed using SPSS, with significance set at $p < 0.05$.

RESULTS: The prevalence of DED was 67.8%, with 19.9% of cases being mild, 18% moderate, and 29.8% severe. Long use of computer screens (77%), fatigue (69.7%), and air pollution (68.9%) were the most commonly reported risk factors for DED. Significant associations were found between DED and factors such as female gender ($p = 0.003$), older age ($p = 0.049$), and prolonged TV screen time ($p = 0.030$). Awareness of DED was high, with 83.1% of participants reporting knowledge of the condition, primarily from internet sources and healthcare professionals. However, only 19.9% reported regular eye doctor visits, and 50.5% used cooling eye drops for symptom relief instead of artificial tears.

CONCLUSION: DED is highly prevalent among Saudi youth, with prolonged screen time, fatigue, and environmental factors contributing to the risk. Awareness is widespread, but healthcare- seeking behavior remains low. Strategies to promote early diagnosis, proper treatment, and preventive measures are needed to reduce the burden of DED in this population.

Introduction

Dry eye disease (DED) stands as a prevalent issue in ophthalmology clinics, characterized by tear film instability, discomfort, and vision problems. Its symptoms, including persistent eye irritation and blurred vision, significantly affect daily life and social interactions, underscoring its public health significance.

Nonetheless, there exists a disparity between observable signs and reported symptoms of DED, with symptoms often resembling those of non-eye-related conditions. Recent studies link DED to chronic pain disorders and suggest a possible genetic link with depression [1].

In DED The pathogenetic triggering mechanism is considered to be stress on the ocular surface, these stressors include environmental causes,

infection, endogenous stress, antigens exposure, and genetic factors. The pathophysiology of DED consists of the proinflammatory cytokines, chemokines, and matrix metalloproteinases that cause autoreactive T helper cells to proliferate and invade the lacrimal gland and ocular surface which leads to an outgoing inflammation and ocular surface damage [2].

Large-scale epidemiological studies indicate that the prevalence of dry eye varies from 5 to 35% across different age groups, with discrepancies likely stemming from varying definitions of the condition. Limited data exists regarding its natural progression and incidence. The significance of dry eye in public health is underscored by its high occurrence among older individuals and the global aging trend. Dry eye adversely affects ocular and overall health, as well as quality of life and visual function. Both direct and indirect costs are associated with managing dry eye [3].

Numerous etiologies contribute to the development of DED and can be classified into environmental such as low humidity, extended screen time, and windy weather. Patient factors such as race of the patient (more seen in Asian individuals), older age, sex in which females are more prone to develop DED than males, presence of Auto-immune diseases (Sjögren syndrome, rheumatoid arthritis, sarcoidosis), and most importantly contact lenses users. Moreover, those who are present with dry eyes must be evaluated with complete ophthalmic examinations. Based on the patient's presentation and eye exam, DED can be classified into mild, moderate, and severe [4].

While traditionally associated with aging populations, there is growing evidence to suggest that DED is increasingly affecting younger age groups, particularly those who spend prolonged periods engaged in digital screen activities [5]. The relationship between extended screen time and DED in youth is a multifaceted issue that warrants comprehensive investigation [6], [7], with as many as 90% of adult computer users reporting dry eye symptoms.

In children, prolonged screen exposure has been linked to myopic progression and changes in the ocular surface. Rates of dry eye disease (DED) in healthy pediatric populations vary from 6.6% to 44% [8]. The widespread adoption of digital devices has led to an unprecedented increase in the duration and intensity of visual tasks performed by young individuals, including reading, gaming, social media engagement, and online learning. Prolonged exposure to digital screens is believed to exacerbate ocular surface symptoms [7].

The mechanism linking extended screen time to DED is thought to involve altered blink dynamics, and disrupting the normal functioning of the tear film, leading to ocular surface changes, some of which may be irreversible [8]. Furthermore, the unique visual demands associated with digital screen use, such as decreased blink frequency and increased exposure to blue light emissions, have been implicated in the pathogenesis of DED. Blue light, a high-energy visible light emitted by digital screens, has been shown to penetrate deeper into the eye and may contribute to oxidative stress, inflammation, and cellular damage within the ocular tissues, thereby exacerbating dry eye symptoms [9], thus significantly impacting patient's quality of life, productivity, learning, and the economy [8].

Despite the growing body of literature examining the relationship between extended screen time and DED, there remains a need for comprehensive research that elucidates the underlying mechanisms driving this association, identifies high-risk populations, and evaluates the effectiveness of preventive and therapeutic interventions. Understanding the complex interplay between digital screen exposure and ocular health is essential for informing public health initiatives, clinical practice guidelines, and educational interventions aimed at promoting healthy screen habits among youth.

This cross-sectional study aims to investigate the correlation between extended screen time, the prevalence of dry eye disease among youth and to assess the awareness of the effects of extended screen time on the eye health. By collecting data on screen time habits and conducting comprehensive ocular assessments, including symptomatology and clinical examinations, we seek to elucidate the relationship between digital screen exposure and ocular health outcomes among this demographic group. Understanding these associations is crucial for informing targeted interventions and promoting healthy screen habits to mitigate the risk of DED in youth.

Methodology

This study utilized a cross-sectional, questionnaire-based design conducted across Saudi Arabia between March 2024 and December 2024. The study population consisted of Saudi adults of both genders, aged 18 years and older. Participants were selected using a simple random sampling technique to ensure a representative sample of the population. The inclusion criteria required participants to be Saudi residents, aged above 18, and capable of completing the survey in either Arabic or English. Exclusion criteria included individuals who were unable to comply with the study requirements or complete the necessary assessments due to language barriers, cognitive impairments, or other factors limiting their active involvement.

To determine the sample size, the Raosoft sample size calculator was used. With a 95% confidence level, 5% margin of error, and an assumed 50% response distribution, the minimum suggested sample size was 385 participants.

Data was collected through an online self-

administered questionnaire, distributed via social media platforms and other digital means. The questionnaire covered demographic information, screen time habits, and self-reported dry eye symptoms. Prior to completing the questionnaire, participants were provided with a comprehensive explanation of the study objectives and their right to decline participation. Informed consent was obtained from all participants before they proceeded with the survey.

After data was extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two tailed tests. P value less than 0.05 was statistically significant. As for dry eye disease assessment, OSDI= [(sum of scores for all questions answered) × 100]/[(total number of questions answered) × 4]. The scores on the three sections are summed to arrive at a final OSDI score, which ranges from 0 to 100, with higher values indicating greater symptom severity [normal (<12), mild (13-22) moderate (23-32) or severe (33-100).

The Descriptive analysis based on frequency and percent distribution was done for all variables participants bio- demographic data, education, job title, and Screen time use.

Also, youth's awareness about dry eye, their practice, and factors affecting risk of having dry eye were tabulated. The overall severity of DED was graphed. Cross tabulation was graph used to assess factors associated with participants' DED and its relationship with awareness and practice with significance evaluated using Persons' chi-square test and exact probability test for small frequency distributions.

Table 1: Personal characteristics of study participants, Saudi Arabia (n=366)

Personal data	No	%
Region		
Central region	327	89.3%
Northern region	8	2.2%
Western region	7	1.9%
Southern region	24	6.6%
Age in years		
19-25	147	40.2%
26-35	66	18.0%
36-55	114	31.1%
> 55	39	10.7%
Gender		
Male	122	33.3%
Female	244	66.7%
Work field		
Not working	56	15.3%
Education / research sector	82	22.4%
Health care sector	125	34.2%
Military sector	21	5.7%
Economic / business sector	53	14.5%
Others	29	7.9%

Ethical approval for the study was obtained from the Research Ethics Committee at our institution. Additionally, approval was secured from the regional health authority. Confidentiality was maintained throughout the study, and participants were informed of their right to withdraw at any stage.

Results

A total of 366 eligible youth completed the study questionnaire; most of them (89.3%) were from the central region. As for age, it ranged from 19 to more than 55 years with a mean age of 28.6 ± 11.7 years old. Exact of 244 (66.7%) participants were females, 125 (34.2%) work at the health care sector, 82 (22.4%) work at the education / research field, 53 (14.5%) work at economic / business field and 21 (5.7%) work at military sector (Table 1).

As for screen time use (Table 2), 245 (66.9%) reported spending 4 or more hours on their phones daily, 81 (22.1%) spending 2-3 hours daily. A total of 236 (64.5%) spend on TV 0 to 1 hour daily and 68 (18.6%) spend 1 to 2 hours daily. Also, 193 (52.7%) use an electronic device other than a TV and mobile phone for 0 to 1 hour daily and 89 (24.3%) spend 4 or more hours daily. As for blinking frequency per minute while looking at the screen, 110 (30.1%) did for less than 5 times and 155 (42.3%) did for 5 to 10 times.

Table 2: Screen time use among study youth, Saudi Arabia

Screen use	No	%
How many hours a day do you spend on your phone?		
0-1 hour	7	1.9%
1-2 hours	33	9.0%
2-3 hours	81	22.1%
4 / more hours	245	66.9%
How many hours a day do you spend on TV?		
0-1 hour	236	64.5%
1-2 hours	68	18.6%
2-3 hours	42	11.5%
4 / more hours	20	5.5%
How many hours a day do you use an electronic device other than a TV and mobile phone?		
0-1 hour	193	52.7%
1-2 hours	48	13.1%
2-3 hours	36	9.8%
4 / more hours	89	24.3%
How many times do you blink per minute while looking at the screen?		
< 5 times	110	30.1%
5-10 times	155	42.3%
10-15 times	71	19.4%
> 15 times	30	8.2%

Table 3 shows study youth's awareness about dry eye, Saudi Arabia. A total of 304 (83.1%) participants heard about dry eyes recently, the most reported source of information included internet (55.3%), physician / nurse (54.6%), family / friends (43.8%), and TV / mass media (9.5%). Exactly 356 (97.3%) think that using electronic devices for a long time may contribute to dry eyes.

Table 3: Study youths' awareness about dry eye, Saudi Arabia

Awareness of dry eye	No	%
Do you think that using electronic devices for a long time may contribute to dry eyes?		
Yes	356	97.3%
No	10	2.7%
Have you seen or heard about dry eyes recently?		
Yes	304	83.1%
No	62	16.9%
Source of information about dry eye		
Physician / nurse	166	54.6%
Family / friends	133	43.8%
Internet	168	55.3%
TV / mass media	29	9.5%
Others	21	6.9%

Severity of dry eye disease based on OSDI questionnaire among study adults is shown in Figure 1. A total of 67.8% of the study participants had DED, which was mild among 19.9%, moderate among 18% and severe among 29.8%.

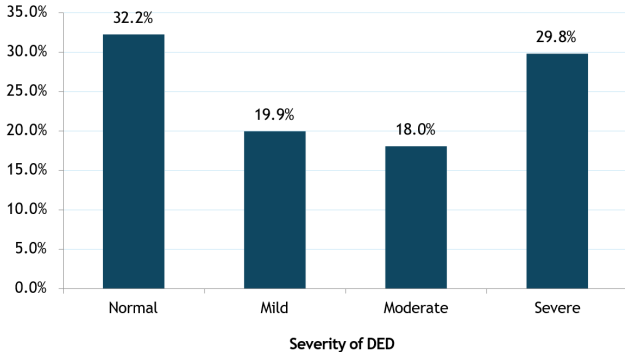

Figure 1: Severity of dry eye disease based on OSD questionnaire among study adults

Factors affecting the risk of having dry eye disease as reported by the study participants are shown in Table 4. The most reported factors that increase the risk for DED as reported by youths in the study were long use of computer screens (77%), fatigue (69.7%), air pollution (68.9%), using contact lenses (68%), decreased eye blink rate (67.5%), old age (62.6%), and DM (60.1%). The least reported factors that increase the risk included female gender (6%), contraceptive pills (12.3%), and Sjögren's syndrome (24.9%).

Table 4: Factors affecting the risk of having dry eye disease as reported by the study participants

Factors	Increase risk		No effect		Reduce risk		Do not know	
	No	%	No effect	%	No	%	No	%
Female gender	22	6.0%	84	23.0%	14	3.8%	246	67.2%
Old age	229	62.6%	24	6.6%	6	1.6%	107	29.2%
Sjögren's syndrome	91	24.9%	20	5.5%	8	2.2%	247	67.5%
DM	220	60.1%	22	6.0%	8	2.2%	116	31.7%
Hypertension	180	49.2%	30	8.2%	8	2.2%	148	40.4%
Thyroid disorders	120	32.8%	24	6.6%	8	2.2%	214	58.5%
Long use of computer screen	282	77.0%	20	5.5%	11	3.0%	53	14.5%
Using contact lenses	249	68.0%	19	5.2%	17	4.6%	81	22.1%
Air pollution	252	68.9%	19	5.2%	13	3.6%	82	22.4%
Vision correction surgery	175	47.8%	24	6.6%	27	7.4%	140	38.3%
Poor sleep quality	212	57.9%	21	5.7%	13	3.6%	120	32.8%
Fatigue	255	69.7%	21	5.7%	13	3.6%	77	21.0%
Decreased eye blink rate	247	67.5%	15	4.1%	15	4.1%	89	24.3%
Sitting behaviors for long periods	148	40.4%	52	14.2%	10	2.7%	156	42.6%
Contraceptive pills	45	12.3%	42	11.5%	11	3.0%	268	73.2%

Table 5 presents participants' practice and diagnosis with dry eye disease, Saudi Arabia. A total of 73 (19.9%) go to regular visits to the eye doctor, 133 (36.3%) diagnosed with dry eye by a doctor mainly in primary care centers (65.4%). Also, 185 (50.5%) purchased cooling eye drops yourself instead of artificial tears to relieve discomfort in their eyes.

Table 5: Participants' practice and diagnosis with dry eye disease, Saudi Arabia

Practice	No	%
Do you go to regular visits to the eye doctor?		
Yes	73	19.9%
No	293	80.1%
Have you been diagnosed with dry eye by a doctor?		
Yes	133	36.3%
No	233	63.7%
If you are diagnosed with dry eye, in what type of center? (n=133)		
It was diagnosed in primary care centers	87	65.4%
Diagnosed in secondary or tertiary referral centers	46	34.6%
Have you purchased cooling eye drops yourself instead of artificial tears to relieve discomfort in your eyes?		
Yes	185	50.5%
No	181	49.5%

Factors associated with dry eye disease among youths, Saudi Arabia are shown in Table 6. A total of 73% of females had DED versus 57.4% of males with a recorded statistical significance (P = 0.003). Also, 76.9% of participants aged more than 55 years had DED compared to 69.4% of others aged 19-25 years (P = 0.049).

Table 6: Factors associated with dry eye disease among youths, Saudi Arabia

Factors	DED				p-value
	Normal		DED		
	No	%	No	%	
Region					
Central region	108	33.0%	219	67.0%	
Northern region	1	12.5%	7	87.5%	0.161^
Western region	0	0.0%	7	100.0%	
Southern region	9	37.5%	15	62.5%	
Age in years					
19-25	45	30.6%	102	69.4%	
26-35	28	42.4%	38	57.6%	0.049*
36-55	36	31.6%	78	68.4%	
> 55	9	23.1%	30	76.9%	
Gender					
Male	52	42.6%	70	57.4%	0.003*
Female	66	27.0%	178	73.0%	
Work field					
Housewife	14	25.0%	42	75.0%	
Education / research sector	23	28.0%	59	72.0%	
Health care sector	46	36.8%	79	63.2%	0.223^
Military sector	4	19.0%	17	81.0%	
Economic / business sector	22	41.5%	31	58.5%	
Others	9	31.0%	20	69.0%	

P: Pearson X2 test; ^: Exact probability test; *P < 0.05 (significant).

Table 7 presents relation between dry eye disease and participants' screen time use, Saudi Arabia.

Table 7: Relation between dry eye disease and participants' screen time use, Saudi Arabia

Screen time use	Normal		DED		DED p-value
	No	%	No	%	
How many hours a day do you spend on your phone?					
0-1 hour	3	42.9%	4	57.1%	
1-2 hours	9	27.3%	24	72.7%	0.860
2-3 hours	26	32.1%	55	67.9%	
4 / more hours	80	32.7%	165	67.3%	
How many hours a day do you spend on TV?					
0-1 hour	88	37.3%	148	62.7%	
1-2 hours	18	26.5%	50	73.5%	0.030*^
2-3 hours	7	16.7%	35	83.3%	
4 / more hours	5	25.0%	15	75.0%	
How many hours a day do you use an electronic device other than a TV and mobile phone?					
0-1 hour	63	32.6%	130	67.4%	
1-2 hours	19	39.6%	29	60.4%	0.530
2-3 hours	9	25.0%	27	75.0%	
4 / more hours	27	30.3%	62	69.7%	
How many times do you blink per minute while looking at the screen?					
< 5 times	34	30.9%	76	69.1%	
5-10 times	56	36.1%	99	63.9%	0.479
10-15 times	21	29.6%	50	70.4%	
> 15 times	7	23.3%	23	76.7%	

P: Pearson X2 test; ^: Exact probability test; *P < 0.05 (significant).

Exact of 83.3% of participants who spend on TV 2 to 3 hours daily had DED versus 62.7% of others who spend 0 to 1 hour daily (P=.030). Other screen time use items showed insignificant relation with having DED.

Table 8 shows the relation between having dry eye disease and participants' awareness and practice. Exact 62.3% of participants' with DED had their information from physicians versus 39% of others without while 53.9% of them had their information from internet versus 58% of those without (P = 0.001). Only 23.8% of those with DED had regular visits to the eye doctor compared to 11.9% of others without (P = 0.008). A total of 59.3% of participants with DED had purchased cooling eye drops instead of artificial tears to relieve discomfort in your eyes compared to 32.2% of those with no DED (P = 0.001).

Table 8: Relation between having dry eye disease and participants' awareness and practice

Awareness and practice	DED				P-value
	Normal		DED		
	No	%	No	%	
Have you seen or heard about dry eyes recently?					
Yes	114	96.6%	242	97.6%	0.595
No	4	3.4%	6	2.4%	
Source of information about dry eye					
Physician / nurse	39	39.0%	127	62.3%	0.001*
Family / friends	44	44.0%	89	43.6%	
Internet	58	58.0%	110	53.9%	
TV / mass media	5	5.0%	24	11.8%	
Others	9	9.0%	12	5.9%	
Do you go to regular visits to the eye doctor?					
Yes	14	11.9%	59	23.8%	0.008*
No	104	88.1%	189	76.2%	
Have you purchased cooling eye drops yourself instead of artificial tears to relieve discomfort in your eyes?					0.001*
Yes	38	32.2%	147	59.3%	
No	80	67.8%	101	40.7%	

P: Pearson X2 test; *P < 0.05 (significant).

Discussion

This study aimed to assess the prevalence of dry eye disease (DED) and explore associated risk factors, screen time usage, awareness, and eye care practices among Saudi youth. The findings revealed a high prevalence of DED among participants, with significant associations between DED and various demographic, behavioral, and environmental factors.

The study reported a DED prevalence of 67.8% based on the Ocular Surface Disease Index (OSDI) questionnaire, with 19.9% experiencing mild, 19.9% moderate, and 18% severe forms of the disease. This prevalence is higher than that reported in some previous studies in Saudi Arabia, such as a prevalence of 38.4% [10], 32.1% in Al-Ahsa [11], and 49.5% among 4,066 healthy adults from five regions [12]. However, our findings are consistent with others, including a study of an urban population in high-altitude areas of Southwest Saudi Arabia, where the prevalence was 66.8% [13], and a broader study that reported a DED prevalence of 74.9% across various regions of Saudi Arabia [14].

Previous research has identified gender and age as significant factors in DED prevalence [15], [16]. Consistent with this, our findings showed that females were more likely to develop DED, with 73% of females reporting DED compared to 57.4% of males (P = 0.003). Additionally, older participants were more likely to experience DED; specifically, 76.9% of participants over 55 years had DED compared to 69.4% of those aged 19-25 (P = 0.049). This correlation may be attributed to age-related changes in tear production and glandular function [18]. While our results align with studies indicating increased DED incidence among females and older individuals [11], [12], [19], some studies have reported no significant gender differences or a higher prevalence in younger populations [10], [19].

Screen time was identified as a critical factor influencing DED prevalence. A significant proportion (66.9%) of participants reported spending four or more hours daily on their phones, while 52.7% used other electronic devices for only 0 to 1 hour daily. Prolonged screen time is a well-documented risk factor for DED due to reduced blink rates and increased tear evaporation, resulting in ocular surface stress [6], [20]. In our study, 30.1% of participants reported blinking fewer than five times per minute while using screens. Although the association between phone use and DED was not statistically significant, there was a substantial relationship between TV screen time and DED; participants who spent 2 to 3 hours daily watching TV were more likely to develop DED (83.3%) compared to those who watched for 0 to 1 hour (62.7%, P = 0.030). These findings corroborate existing literature linking extended screen time to dry eye symptoms [5], [6], [8], [10], [21], [22], [23], [24].

The study also assessed participants' awareness of DED, revealing that 83.1% had heard of the condition. The internet (55.3%) and healthcare providers (54.6%) were the primary sources of information, underscoring the role of online platforms and healthcare professionals in disseminating health-related information. Notably, a higher percentage of participants with DED (62.3%) received information from physicians compared to those without DED (39%, P = 0.001), suggesting that those experiencing dry eye symptoms are more likely to seek professional advice.

In terms of risk factor identification, participants highlighted prolonged computer use (77%), fatigue (69.7%), air pollution (68.9%), and contact lens use (68%) as major contributors to DED. These results align with prior research indicating that digital eye strain, environmental factors, and contact lens use significantly contribute to dry eye symptoms [25], [26]. Notably, reduced blinking during screen use exacerbates dry eye by increasing tear evaporation and reducing tear film stability. Additionally, diabetes mellitus (DM) was identified by 60.1% of participants as a risk factor for DED, aligning with literature that links DM to reduced tear production and lacrimal gland function [27], [28]. Interestingly, only 6% and 12.3%

identified female gender and contraceptive pill use as risk factors, despite evidence suggesting hormonal influences can contribute to DED development, particularly in women [17].

The study also revealed important practices related to eye care among participants. Only 19.9% reported regular visits to an eye doctor, a concerning statistic given the high prevalence of DED. Regular eye care prevents disease progression, particularly in symptomatic individuals [29]. Among those diagnosed with DED, 23.8% attended regular eye doctor visits compared to 11.9% of those without DED (P = 0.008), indicating that those with a diagnosis may be more likely to seek consistent medical care. Furthermore, 50.5% of participants reported purchasing cooling eye drops for eye discomfort, with a higher proportion of DED sufferers (59.3%) using them compared to those without DED (32.2%, P = 0.001). While cooling eye drops are commonly used, they may provide only temporary relief and do not address the underlying causes of DED [30].

While this study provides valuable insights into DED prevalence and risk factors among Saudi youth, it has limitations. The sample size may restrict the generalizability of findings, particularly since most participants were from the central region of Saudi Arabia. Reliance on self-reported data may also introduce recall bias or inaccuracies in symptom and behavior reporting. Additionally, the cross-sectional design limits our ability to establish causal relationships between screen time, risk factors, and DED. Longitudinal studies could offer more robust evidence on the impact of these factors over time. Future research should also explore DED prevalence across different age groups in Saudi Arabia to develop targeted interventions for older adults, who are also at high risk for DED.

Conclusions

In conclusion, this study demonstrated a high prevalence of DED among Saudi youth, with significant associations with factors such as screen time, gender, age, and blinking frequency. The findings underscore the need for increased awareness of DED risk factors and the importance of regular eye care. Public health initiatives aimed at reducing screen time, promoting proper eye hygiene, and encouraging routine medical consultations could help mitigate the rising incidence of DED, particularly among heavy screen users. Future studies should focus on expanding the sample size, including objective clinical measures of DED, and exploring interventions to prevent and manage the condition across diverse populations.

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