Original Article

Symptomatic dry eye disease among university students

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ABSTRACT

Background: Dry eye disease (DED) is a multifactorial condition often characterized by a reduction in tear film quantity or quality. This study aimed to determine the frequency of DED and its associated subjective symptoms among students of Mu'tah University.

Methods: In this cross-sectional study conducted at Mu'tah University, Mu'tah, Jordan, from January to April 2022, 489 students completed an online patient-reported DED symptom questionnaire and the ocular surface disease index (OSDI) questionnaire. Moreover, 106 participants underwent clinical examinations using the Schirmer test I and fluorescein tear breakup time (TBUT).

Results: Approximately 74.6% of the students self-reported experiencing DED symptoms, and 72.6% had an OSDI score > 12, which is considered the threshold for an abnormal ocular surface. Clinical examinations revealed low Schirmer test scores (< 10 mm) in 26.4% (n = 28) and 25.5% (n = 27) of the right and left eyes, respectively. We observed low TBUT scores (< 5 s) in 19.8% (n = 21) and 18.9% (n = 20) of the right and left eyes, respectively. We noted significant differences between the self-reported DED symptoms and the Schirmer test scores ($P = 0.003$ for both right and left eyes), TBUT ($P < 0.001$ for both right and left eyes), and OSDI score ($P < 0.001$ for each self-reported DED symptom). We observed a weak significant positive correlation between Schirmer test scores and TBUT in the right (r = + 0.30; $P = 0.002$) and left (r = + 0.34; $P < 0.001$) eyes; a negligible significant inverse correlation between OSDI scores and Schirmer test scores in the right (r = - 0.24; $P = 0.013$) and left (r = - 0.23; $P = 0.019$) eyes; and a negligible significant inverse correlation between the OSDI score and TBUT of the left eye (r = - 0.25; $P = 0.011$) but not of the right eye (r = - 0.17; $P = 0.077$).

Conclusions: The frequency of DED symptoms in this study was higher than that previously reported based on foreign statistics. The presence of self-reported DED symptoms was significantly associated with higher OSDI scores. Self-reported DED symptoms were more frequent than the abnormalities detected using objective methods. Therefore, a combination of subjective and objective measures may provide higher diagnostic yield for DED. Further studies are required to confirm this hypothesis.

KEYWORDS

dry eye disease, tear, dysfunctional tear syndrome, OSDI, ocular surface disease index, lubricant eye drop, Schirmer's test, tear break-up time

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INTRODUCTION

Dry eye disease (DED) is a multifactorial condition of the ocular surface characterized by ocular symptoms and the loss of tear film homeostasis. Tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities have etiological roles [1]. DED varies in prevalence among populations, reaching as high as 50%. Women, Asians, and older individuals are the most commonly affected [2].

Symptoms of DED include ocular pain, often accompanied by light sensitivity, foreign body sensation, irritation, and visual symptoms, notably fluctuating or blurred vision [3]. The presence and severity of DED can be objectively determined using several methods. These include questionnaires, such as the ocular surface disease index (OSDI), and clinical tests, which include the Schirmer test, fluorescein tear breakup time (TBUT), and tear film osmolarity, among others [4].

However, there is a notable discrepancy between reported symptoms and measured data [5, 6]. This discrepancy can be attributed to the lack of well-defined diagnostic criteria for commonly used clinical tests, the heterogeneity of DED itself, the subjective nature of symptoms, individual variations in pain thresholds and cognitive responses to questions about ocular sensation, and a reduction in ocular surface sensitivity as a result of the normal aging process or disease progression [7].

In this study, we examined the frequency of DED among Mu'tah University students using the OSDI questionnaire and compared the results with the subjective, self-reported symptoms of DED. In addition, a subset of participants underwent clinical testing using the Schirmer test I and TBUT to compare these methods of diagnosing DED.

METHODS

We conducted this cross-sectional study from January to April 2022 across all 14 faculties at Mu'tah University, Mu'tah, Jordan. The study was approved by the ethical committee of Mu'tah University and by the dean of each of the 14 faculties. Informed consent was obtained from each participant. We allocated the 14 faculties to one of three groups: (1) medical faculties, including the Faculties of Medicine, Pharmacy, and Nursing; (2) scientific faculties, including the Faculties of Engineering, Science, Information Technology, and Agriculture; and (3) literary faculties, including the Faculties of Arts, Business, Law, Social Sciences, Sharia, Educational Sciences, and Sports Science. We selected a stratified systematic random sample of 489 undergraduate Jordanian students aged > 18 years.

We asked participants to complete an online survey utilizing Google Drive and the well-structured, validated, and reliable Arabic version of the OSDI questionnaire [8]. All faculties were properly familiarized with the study and were asked to encourage their students to complete the questionnaire. A total of 489 recruited participants responded with completed questionnaires.

This study comprised two phases, the first of which incorporated three stages. The first stage consisted of questions regarding socio-demographic characteristics of the participants. These included age; sex (male or female); faculty (medical, scientific, or literary); place of residence (dormitory, southern Jordan, middle Jordan, or northern Jordan); marital status (single or married); smoking status (active smoker or not an active smoker); chronic medical conditions (hypertension, diabetes mellitus, rheumatological disease, thyroid disorder, or any other chronic medical condition, with the students identified as either having or not having a chronic medical condition); ophthalmological diseases (none; presence or absence of refractive errors; keratoconus; retinal diseases, mainly juvenile macular degeneration [Stargardt disease, Best disease, or juvenile retinoschisis], retinitis pigmentosa, or retinal detachment); previous ocular surgeries (yes or no), mainly refractive surgeries or any intraocular surgeries for conditions such as congenital cataract or retinal detachment; use of contact lenses (yes or no); and use of artificial tears (yes or no).

The second stage of the first phase, designed and reviewed by three independent ophthalmologists, included questions regarding DED symptoms, including the presence or absence of eye redness, pain, grittiness, burning sensation, itchiness, blurring of vision, and/or excessive tearing [9].

The third stage of the first phase was the OSDI questionnaire, which includes 12 questions in three groups [8]. The first group of questions pertains to the ocular symptoms of DED. The second group focuses on ocular symptoms that interfere with watching television, reading a book, driving at night, and/or using a computer. The third group pertains to ocular symptoms induced by environmental factors, such as windy conditions, dry environment, and air-conditioned areas. The OSDI score is calculated using the following formula: $12.5 \times [(\text{sum of individual question scores}) / (\text{number of questions answered})]$. The OSDI score is assessed on a scale of 0 to 100, with higher scores indicating greater disability. The participants were classified according to their OSDI

scores as follows: normal ocular surface (0–12 points) or mild (13–22 points), moderate (23–32 points), or severe (33–100 points) ocular surface disease [8, 10-12].

The second phase of the study, in which only 106 students opted to enroll, was a clinical examination for DED using the Schirmer test I, TBUT, and slit-lamp biomicroscopy examination. These participants underwent complete ophthalmological examinations including measurement of best-corrected distance visual acuity using a Snellen chart (Auto Chart Projector CP-670; Nidek Co., Ltd., Gamagori, Japan); intraocular pressure measurement using the Goldmann applanation tonometer (Applanation Tonometer T170 R Type; MediWorks Precision Instruments Co., Ltd., Shanghai, China); and undilated and dilated slit-lamp biomicroscopy examination (Slit Lamp Microscope; MediWorks Precision Instruments Co.) for anterior and posterior segment assessment, respectively.

For the TBUT test, a fluorescein strip (Fluoro Touch; Madhu Instruments Pvt. Ltd., Okhla Industrial Area, New Delhi, India) was applied to the lower fornix and then removed. Participants were instructed to blink twice, stop blinking, and maintain their gaze. The tear film was observed using slit-lamp biomicroscopy with a cobalt blue filter. The time between the last blink and the appearance of a dark spot or definite break was recorded. An interval < 5 s was considered abnormal [13]. For the Schirmer test I, a filter paper test strip (Tear Touch Blu; Madhu Instruments) was used without anesthesia to measure tear production over 5 min. The strip was placed in the temporal position of the lower eyelid fornix. Participants were instructed to look forward and blink normally. Wetting of the paper strip to < 10 mm after 5 min was considered abnormal [14].

The collected data were analyzed using the Statistical Package for the Social Sciences software (version 26; SPSS Inc., IBM Corp., Armonk, NY, USA). The Shapiro – Wilk test was used to assess the normality of the data distribution. Data are summarized as means and standard deviations (SDs) for numerical variables, and as frequencies and percentages for categorical variables. Inferential statistics were performed using the Cochran – Armitage test of trend, chi-square test, *t*-test, and Pearson's correlation coefficient, when applicable. A *P*-value < 0.05 was considered to indicate statistical significance.

RESULTS

Table 1 summarizes the sociodemographic and medical characteristics of 489 students from Mu'tah University. Most students were single (98.4%), female (58.5%), from medical faculties (79.6%), not active smokers (76.7%), and without known medical (97.1%) or ophthalmic (67.5%) comorbidities. More than 90% of students had no history of eye surgery or contact lens use, and 84.3% reported not using over-the-counter artificial tears (Table 1).

Table 1. Socio-demographic and medical characteristics of 489 recruited Mu'tah University students

Variables	Value
Age (y), Mean ± SD	21.6 ± 2.7
Sex (Male / Female), n (%)	203 (41.5) / 286 (58.5)
Faculty (Medical faculties / Literary faculties / Scientific faculties), n (%)	389 (79.6) / 59 (12.1) / 41 (8.4)
Place of residence (dormitory / Southern Jordan / Middle Jordan / Northern Jordan), n (%)	239 (48.9) / 177 (36.2) / 59 (12.1) / 14 (2.9)
Marital status (Single / Married), n (%)	481 (98.4) / 8 (1.6)
Smoking status (Active smoker / Not an active smoker), n (%)	114 (23.3) / 375 (76.7)
Chronic medical conditions (Yes / No), n (%)	14 (2.9) / 475 (97.1)
***Ophthalmological diseases (None / Refractive error / KCN / Retinal disease), n (%)**	330 (67.5) / 155 (31.7) / 2 (0.4) / 2 (0.4)
****Eye surgery (Yes / No), n (%)**	30 (6.1) / 459 (93.9)
Use of contact lenses (Yes / No), n (%)	36 (7.4) / 453 (92.6)
*****Use of artificial tears (Yes / No), n (%)**	77 (15.7) / 412 (84.3)

Abbreviations: y, years; SD, standard deviation; n, number of participants; %, percentage; KCN, Keratoconus. *Both patients with retinal diseases had retinitis pigmentosa; **Of 30 students with a history of eye surgery, 27 had photorefractive keratectomy and 3 had phacoemulsification and intraocular lens implantation; ***Types of artificial tears used by 77 students included: (1) *Ginkgo biloba* 0.05% dry extract and hyaluronic acid 0.15% (TRIUM® eye drops; Sooft Italia SpA, Montegiorgio, Italy); (2) HMWHA 0.15% (Comfort Shield® eye drops; i.com medical GmbH, Munich, Germany); (3) sodium hyaluronate 0.2% (Hyfresh™ eye drops; Jamjoom Pharma Co., Jeddah, Saudi Arabia); (4) carboxymethylcellulose sodium 0.5% (Refresh Plus®; Allergan, Inc., USA); (5) sodium hyaluronate 0.24% (Artelac® Ectoin; Bausch & Lomb Ltd., USA); and (6) preservative-free eye drops containing sodium hyaluronate 0.30% and amino acids (Blue Gel A®; Sooft Italia SpA, Montegiorgio, Italy).

The mean (SD) OSDI score of the sample was 29.79 (24.02), and using this score, 27.4% had normal ocular surface (n = 134), and 17.6% (n = 86) had mild, 13.3% (n = 65) had moderate, and 41.7% (n = 204) had severe ocular surface disease. Furthermore, 365 (74.6%) participants self-reported experiencing DED symptoms. Table 2 summarizes the frequencies of self-reported DED symptoms and their associations with OSDI score severity. Students who reported ocular symptoms of eye redness, eye pain, grittiness, burning sensation, itchiness, blurring of vision, and excessive tearing were significantly more likely to have a higher OSDI score, indicating severe ocular surface disease (all $P < 0.001$) (Table 2).

Of the 489 students, 106 underwent detailed clinical examinations, the Schirmer test I, and TBUT. Table 3 summarizes the sociodemographic and medical characteristics of these participants. This sample had a male-to-female ratio of 1:1, indicating a balanced sex distribution, with a mean (SD) age of 22.4 (1.7) years, indicating similarity of ages. Most students were single (99.1%), from medical faculties (96.2%), not active smokers (67.9%), without history of eye surgery (89.6%) or contact lens use (89.6%), and without known medical (98.1%) or ophthalmic (75.5%) comorbidities; 79.2% reported not using over-the-counter artificial tears (Table 3).

The mean (SD) Schirmer test scores for the right and left eyes were 16.85 mm (9.66 mm) and 17.10 mm (9.99 mm), respectively. Twenty-eight (26.4%) and 27 (25.5%) students had abnormal Schirmer test scores

Table 2. Self-reported ocular symptoms of dry eye disease and their associations with OSDI score severity

Ocular Symptom	Total, n (%)	OSDI score, n (%)				*P*-value
		Normal, 134 (27.4)	Mild, 86 (17.6)	Moderate, 65 (13.3)	Severe, 204 (41.7)	
Eye redness (Present / Absent)	168 (34.4) / 321 (65.6)	8 (4.8) / 126 (39.3)	27 (16.1) / 59 (18.4)	28 (16.7) / 37 (11.5)	106 (63.1) / 98 (30.5)	**< 0.001**
Eye pain (Present / Absent)	140 (28.6) / 349 (71.4)	15 (10.7) / 119 (34.1)	18 (12.9) / 68 (19.5)	19 (13.6) / 46 (13.2)	88 (62.9) / 116 (33.2)	**< 0.001**
Grittiness (Present / Absent)	81 (16.6) / 408 (83.4)	6 (7.4) / 128 (31.4)	11 (13.6) / 75 (18.4)	6 (7.4) / 59 (14.5)	58 (71.6) / 146 (35.8)	**< 0.001**
Burning sensation (Present / Absent)	228 (46.6) / 261 (53.4)	26 (11.4) / 108 (41.4)	43 (18.9) / 43 (16.5)	29 (12.7) / 36 (13.8)	130 (57.0) / 74 (28.4)	**< 0.001**
Eye itchiness (Present / Absent)	170 (34.8) / 319 (65.2)	14 (8.2) / 120 (37.6)	28 (16.5) / 58 (18.2)	29 (17.1) / 36 (11.3)	99 (58.2) / 105 (32.9)	**< 0.001**
Blurring of vision (Present / Absent)	140 (28.6) / 349 (71.4)	12 (8.6) / 122 (35.0)	19 (13.6) / 67 (19.2)	6 (4.3) / 59 (16.9)	103 (73.6) / 101 (28.9)	**< 0.001**
Excessive tearing (Present / Absent)	85 (17.4) / 404 (82.6)	7 (8.2) / 127 (31.4)	18 (21.2) / 68 (16.8)	13 (15.3) / 52 (12.9)	47 (55.3) / 157 (38.9)	**< 0.001**

Abbreviations: OSDI, the ocular surface disease index questionnaire; n, number of participants; %, percentage. Note: *P*-values < 0.05 are shown in bold; The OSDI score, is calculated using the following formula: 12.5 × [(sum of individual question scores) / (number of questions answered)] and assessed on a scale of 0 to 100, with higher scores representing greater disability. The participants were classified according to their OSDI score into normal ocular surface (0–12 points) or mild (13–22 points), moderate (23–32 points), or severe (33–100 points) ocular surface disease [8, 10-12].

Table 3. Socio-demographic and medical characteristics of 106 Mu'tah University students who opted for clinical examination

Variables	Value
Age (y), Mean ± SD	22.4 ± 1.7
Sex (Male / Female), n (%)	54 (50.9) / 52 (49.1)
Faculty (Medical faculties / Literary faculties / Scientific faculties), n (%)	102 (96.2) / 3 (2.8) / 1 (0.9)
Place of residence (dormitory / Southern Jordan / Middle Jordan / Northern Jordan), n (%)	56 (52.8) / 35 (33.0) / 11 (10.4) / 4 (3.8)
Marital status (Single / Married), n (%)	105 (99.1) / 1 (0.9)
Smoking status (Active smoker / Not an active smoker), n (%)	34 (32.1) / 72 (67.9)
Chronic medical conditions (Yes / No), n (%)	2 (1.9) / 104 (98.1)
Ophthalmological diseases (None / Refractive error / KCN / Retinal disease), n (%)	80 (75.5) / 26 (24.5) / 0 (0.0) / 0 (0.0)
Eye surgery (Yes / No), n (%)	11 (10.4) / 95 (89.6)
Use of contact lenses (Yes / No), n (%)	11 (10.4) / 95 (89.6)
Use of artificial tears (Yes / No), n (%)	22 (20.8) / 84 (79.2)

Abbreviations: y, years; SD, standard deviation; n, number of participants; %, percentage; KCN, Keratoconus.

Table 4. Differences in tear stability and tear production between students with symptomatic and asymptomatic dry eye disease

Laterality	Symptom status	n (%)	Schirmer test I, Mean ± SD	*P*-value	TBUT, Mean ± SD	*P*-value
Right eye	**Symptomatic**	58 (54.7)	14.36 ± 9.46	**0.003**	5.95 ± 2.16	**< 0.001**
	Asymptomatic	48 (45.3)	19.85 ± 9.12		10.08 ± 4.40	
Left eye	**Symptomatic**	64 (60.4)	14.80 ± 9.43	**0.003**	6.05 ± 2.27	**< 0.001**
	Asymptomatic	42 (39.6)	20.62 ± 9.91		10.12 ± 4.12	

Abbreviations: n, number of eyes; %, percentage; SD, standard deviation; TBUT, fluorescein tear breakup time. Note: *P*-values < 0.05 are shown in bold.

for the right and left eyes, respectively. The mean TBUT scores for the right and left eyes were 7.82 s (3.93 s) and 7.66 s (3.70 s), respectively. Twenty-one (19.8%) and 20 (18.9%) students had abnormal TBUT scores for the right and left eyes, respectively. Regarding the self-reported symptoms of DED, 58 (54.7%) students complained of symptoms in the right eye and 64 (60.4%) in the left eye (Table 4). The mean Schirmer test scores for the asymptomatic right (19.85 mm) and left (20.62 mm) eyes were significantly higher than those for the symptomatic right (14.36 mm) and left (14.80 mm) eyes (both $P = 0.003$). Similarly, the mean TBUT scores for the asymptomatic right (10.08 s) and left (10.12 s) eyes were significantly higher than those for the symptomatic right (5.95 s) and left (6.05 s) eyes (both $P < 0.001$) (Table 4).

Among the 106 participants who underwent clinical examination, we observed a weak significant positive correlation between the Schirmer test score and TBUT in the right ($r = +0.30$; $P = 0.002$) and left ($r = +0.34$; $P < 0.001$) eyes; a negligible significant inverse correlation between OSDI score and Schirmer test score in the right ($r = -0.24$; $P = 0.013$) and left ($r = -0.23$; $P = 0.019$) eyes; and a negligible significant inverse correlation between the OSDI score and TBUT of the left eye ($r = -0.25$; $P = 0.011$) but not of the right eye ($r = -0.17$; $P = 0.077$).

DISCUSSION

Among the 489 students, 365 (74.6%) reported experiencing DED symptoms, including eye redness (34.4%), eye pain (28.6%), grittiness (16.6%), burning sensation (46.6%), eye itching (34.8%), blurred vision (28.6%), and/or excessive tearing (17.4%). These frequencies were significantly higher than those recorded by Ahn et al., who reported the presence of dryness of the eye or a sense of irritation in 14.4% of the Korean population aged 19 to 95 years [15]. Asiedu et al. reported a 44.3% prevalence of symptomatic DED among 700 undergraduate university students [16].

Although the relationship between subjective symptoms of DED and objective findings cannot be accurately stated [1], combining the OSDI questionnaire, Schirmer test, and TBUT is the optimal method for diagnosing and evaluating DED [17]. In our study, the mean (SD) OSDI score of university students was 29.79 (24.02), and approximately three-quarters (n = 355, 72.6%) had an OSDI score > 12, which is the threshold for an abnormal ocular surface. This is similar to the findings of Shanti et al. [18], who observed that 71% of the population had an OSDI score > 12.9. We observed that OSDI score had a significant correlation with the Schirmer test score and TBUT. Moreover, the mean Schirmer test score and TBUT in symptomatic eyes were significantly lower than those in asymptomatic eyes. Therefore, combining OSDI as a subjective parameter [19] with objective tests such as the Schirmer test and TBUT [20] may improve the diagnosis of DED [17].

We observed that students with any of the self-reported ocular DED symptoms, such as eye redness, pain, grittiness, burning, itching, blurring of vision, and excessive tearing, were significantly more likely to have higher OSDI scores. The International Task Force guidelines for DED diagnosis and treatment include a 4-level severity-grading scheme based on signs and symptoms [21]. The Task Force panelists agreed on three relevant symptoms: ocular discomfort, tear substitute requirements, and visual disturbances. Symptoms of ocular discomfort include itching, scratching, burning, foreign body sensation, and photophobia [21]. As in the current study, Barber et al. observed a significant worsening of OSDI scores with increasing International Task Force severity level [22].

We observed abnormal Schirmer test scores and TBUT in more than a quarter and approximately one-fifth of participants' right and left eyes, respectively. The mean (SD) Schirmer test scores were 16.85 mm (9.66 mm) for the right eye and 17.10 mm (9.99 mm) for the left eye, which is higher than reported (11.9 mm [9.8 mm]) by Hu et al. [23]. The mean (SD) TBUT score was 7.82 s (3.93 s) for the right eye and 7.66 s (3.70 s) for the left eye, which is slightly higher than what was observed (4.17 [1.97]) by Jie et al. [24]. The variability in results among different studies may be attributed to differences in the study population, ethnicity, and age.

We observed a significant correlation between TBUT and the Schirmer test scores, consistent with the findings of Nichols et al. [25]. However, the OSDI scores had a negligible significant correlation with the Schirmer test scores but not TBUT, which is in contrast to the findings of Unlu et al., who reported that OSDI correlates well with TBUT but not with Schirmer test scores [26]. This contradiction may be attributable to differences in study methodology; for example, the target population in the current study was a random sample of university students with a mean [SD] age of 22.4 [1.7]), of whom 49.1% were female. Unlu et al. [26] enrolled employees of Umraniye Training and Research Hospital, who used computers for work purposes, with a higher mean [SD] age (29.09 [6.73] years) and female predominance (82.9%). These differences in mean age, sex distribution, and geographical regions of the target populations may explain the varying results obtained in the two studies. However, we believe that multicenter studies involving a wide range of racial and ethnic classes in different age groups are necessary to verify or invalidate this reasoning.

Clayton et al. observed that a web-based instrument yielded scores equivalent to those obtained by paper-and-pencil versions of several ophthalmic patient-reported outcome questionnaires such as the OSDI [27]. Thus, we asked students to complete an online survey using Google Drive and a validated Arabic version of the OSDI questionnaire [8]. Regarding participants with normal OSDI scores, eye redness was reported in 4.8%, eye pain in 10.7%, grittiness in 7.4%, burning sensation in 11.4%, itchiness in 8.2%, blurring of vision in 8.6%, and/or excessive tearing in 8.2% of respondents. By relying on one diagnostic tool and ignoring the other, some cases of symptomatic DED may be overlooked. Therefore, combining the OSDI with self-reported DED symptoms may provide higher diagnostic yield, which must be verified in further studies. Onwubiko et al., in a cross-sectional hospital-based screening survey of 402 participants with a wide age range, found the highest percentage of participants having ocular discomfort symptoms, followed by low TBUT and low Schirmer test scores [28].

This study used a cross-sectional design involving 489 participants from various faculties at Mu'tah University, providing a diverse and representative sample. The comprehensive nature of the survey, which included sociodemographic characteristics, self-reported symptoms, and the OSDI questionnaire, allowed for a holistic assessment of DED. Additionally, the inclusion of clinical examinations, specifically, the Schirmer test I and TBUT, added objective data to the subjective reports. Along with these strengths, this study has certain limitations. The cross-sectional design restricted the establishment of causal relationships and the exploration of temporal trends in DED among university students [29]. Reliance on self-reported symptoms introduces a potential recall bias and subjective interpretation [30], potentially affecting the accuracy of the reported prevalence of DED. The participation rate in clinical examinations was relatively low (106 of 489), which may have introduced a selection bias, potentially influencing the generalizability of the clinical findings. Our focus on a single university may also limit the generalizability of the results [31] to broader populations or different geographical regions. The absence of a longitudinal component also hinders the exploration of potential risk factors [32]. Future studies should adopt a longitudinal design to capture the dynamic nature of DED and its evolution over time. Given the discrepancy between self-reported symptoms and clinical signs, research should focus on refining the diagnostic criteria and exploring novel methods for a more accurate and comprehensive diagnosis of DED. Multicenter studies involving diverse populations and geographic locations may enhance the external validity of the findings. Investigating the impact of specific risk factors relevant to the university student population, such as screen time and study habits, may provide valuable insights. Interventional studies evaluating the effectiveness of preventive measures and therapeutic interventions for DED among university students are warranted. Finally, further studies with robust designs should aim to establish standardized diagnostic criteria using clinical tests and to address the existing variability in measurements and interpretations. This would contribute to a more consistent and reliable assessment of DED in different studies and populations.

CONCLUSIONS

The frequency of DED symptoms among university students was 74.6%, which is higher than the average previously reported using foreign statistics. The presence of self-reported ocular DED symptoms was significantly associated with higher OSDI scores. Self-reported symptoms of DED appear more frequent than abnormalities detected using objective methods. Moreover, some students with normal OSDI scores reported ocular symptoms. Therefore, a combination of subjective and objective measures may provide higher diagnostic yield for DED. Further population-based studies are required to confirm this hypothesis.

ETHICAL DECLARATIONS

Ethical approval: The study was approved by the ethical committee of Mu'tah University and by the dean of each of the 14 faculties. Informed consent was obtained from each participant.
Conflict of interest: None.

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