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Original article

Cross-cultural validation of the Arabic version of the Dry Eye Questionnaire-5 (DEQ-5) scale

Samira Bouazza[1], Samira Abbouyi[1], Mohammed El Amine Ragala[2,3], Jaouad El Hilaly[4], Karima El Rhazi[1], Btissame Zarrouq[1,2]

[1]Laboratory of Epidemiology and Research in Health Sciences, Faculty of Medicine and Pharmacy, Sidi Mohamed Ben Abdellah University, Fez, Morocco; [2]Department of Biology and Geology, Teachers Training College (Ecole Normale Superieure), Sidi Mohamed Ben Abdellah University, Fez, Morocco; [3]Laboratory of Natural Substances, Pharmacology, Environment, Modeling, Health & Quality of Life, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco; [4]Laboratory of Pedagogical and Didactic Engineering of Sciences and Mathematics, Regional Center of Education and Training (CRMEF) of Fez, Fez, Morocco

Abstract. *Background and aim:* The Dry Eye Questionnaire-5 (DEQ-5) and the Ocular Surface Disease Index (OSDI) are recommended scales by TFOS DEWS II Diagnostic Methodology report to apprehend patients with symptoms of dry eyes. Before their use, these scales must undergo a cross-cultural adaptation to the target population. The purpose of this work is to validate the Arabic version of the DEQ-5. *Methods:* Forward-backward translation process was used. The reliability of the Arabic DEQ-5 was computed with Cronbach α. Discriminant validity of DEQ-5 was explored by analysis of variance with the Arabic version of the OSDI (Arabic OSDI) used as gold standard. The concurrent validity was examined by Pearson's correlation coefficient, receiver operating characteristic (ROC) curve was generated, and the cut-off of the Arabic DEQ-5 was produced. Rasch model and Exploratory Factor Analysis were performed to explore its dimentionality. *Results:* The Arabic DEQ-5 met the Rasch analysis criterion of unidimensionality with an Eigenvalue of the first contrast of 1.7, measurement precision of 2, and reliability of 0.8. The average scores measured by Arabic DEQ-5 in the 4 categories defined by Arabic OSDI were significantly different from each other (F=26.20, d=3, P<0.0001) except for those in the mild and moderate category. The Pearson correlation coefficient between the total scores of these questionnaires was r = 0.69 (P<0.0001), and a good agreement was reveled between them. The optimal cut-off of the Arabic DEQ-5 was 5.5. *Conclusions:* Arabic DEQ-5 is a valid and reliable instrument to be used in Arab population. (www.actabiomedica.it)

Key words: 5-item Dry Eye Questionnaire, ocular surface disease index, dry eye disease, Arabic, cross-cultural validation

Background

The definition and diagnosis of dry eyes have undergone adjustments since 1995 to attain a consensus definition in 2017 which considers both tear film instability, inflammation ocular surface, and neural factors influencing ocular surface homeostasis (1). The purpose of these adjustments has been to include objective criteria that measure the signs of the disease, and subjective criteria that measure its symptoms (2). Thus, The Tear Film and Ocular Surface Dry Eye Workshop II (TFOS DEWS II) states in 2017 that dry eye disease (DED) is "a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms in which tear film instability and hyperosmolarity, ocular

surface inflammation and damage, and neurosensory abnormalities play etiological roles" (3). This disease arouses a lot of interest because it has negative repercussions on several facets of the daily life of the individual. In fact, DED affects both the productivity (4,5) of the individual as well as his quality of life and vision (6), and his mental health (7,8). The overall prevalence as reported by TFOS DEWS II Epidemiology Report varies between 5% and 50%, this wide range is due partly to the diagnostic criteria used, the populations targeted, and to the methodological differences between studies (2). Concerning risk factors for dry eyes; the most mentioned in the literature are age, sex, use of contact lenses, overuse of screens, cigarettes, alcohol, weather conditions, autoimmune diseases (e.g., Sjögren's syndrome, Rheumatoid arthritis), ocular surface diseases (e.g., meibomian gland dysfunction, keratoconus, blepharitis), and use of antiallergic or antidepressant drugs (8–14). For the diagnostic of dry eye, it is important to note that several studies have shown a discrepancy between the information on the state of the ocular surface provided by the measurements of symptoms and those provided by the measurements of clinical signs (15). For this reason, a hierarchical diagnosis has been recommended by TFOS DEWS II Diagnostic Methodology report. In the first-place, preliminary questions on the risk factors are used to eliminate the cases which can be confused with DED. The diagnosis itself consists of two stages: the first consists of a questionnaire evaluating the symptoms of the disease, and patients who are suspected with DED will be subject to clinical examinations of the second stage (breakup time, osmolarity and ocular surface staining). Then a classification of the type of DED from which the patient suffers is made possible by the measurement of the Meibomian glands disfunction, the lipids thickness/dynamics, and tears volume (16). Since clinical examinations cannot be approached without an affirmative symptomatological test, questionnaires subjectively measuring the presence of symptoms of DED are very important in the management of this disease. An inventory of the questionnaires that have been developed for this purpose revealed the existence of 24 scales up to 2019 and which have different psychometric properties (17). The Ocular Surface Disease Index (OSDI) and the Dry Eye Questionnaire-5 (DEQ-5) are the questionnaires recommended by TFOS DEWS II Diagnostic Methodology report to be used to discriminate between individuals who have dry eyes symptoms and those who do not have (16). Developed in 1997, OSDI scale is one of the most widely used scale for measuring symptoms of DED in different populations. It is a very useful 12-item instrument for estimating the symptoms of DED and its effects on daily living within the previous week. Originally developed in English, this tool has undergone several cross-cultural adaptations and has shown good psychometric properties (17) including its Arabic version (18). Concerning the DEQ-5, this questionnaire was created in English in 2009 (19); it is the short version of Dry Eye Questionnaire (DEQ) (15) comprising 5 items and evaluating the intensity and frequency of symptoms of DED within the month before. The cross-cultural validations that this screening tool has already undergone are in Spanish (20,21) and Portuguese (22). Therefore, it is important to introduce a validate Arabic version of the DEQ-5 to explore this disease among the Arab population. To our knowledge, there hasn't been any cross-cultural validation study of the DEQ-5 for the Moroccan population. The aim of this study is to evaluate the reliability and validity of the Arabic version of the DEQ-5 questionnaire in non-clinical Moroccan population using the Arabic version of the OSDI (Arabic OSDI) as gold standard.

Methods

Study design and ethical considerations

A cross-sectional, web-based study was carried out in Morocco between January 2023 and February 2023. Concerning the distribution of the questionnaires, we opted for the snowball method with the choice of six seeds in order to ensure better representativeness of age group, educational level, and gender. These seeds used social networks to send the link of the questionnaire via Google Form to the Moroccan participants who have not recently undergone eye surgery, do not wear contact lenses, and are over 18 years old. All participants consented electronically before completing

the survey voluntarily and anonymously. Ethical approval was obtained from the hospital-university ethics committee of Sidi Mohamed Ben Abdellah University (N°16/22). The DEQ-5 questionnaire was used with direct permission from Dr. Robin Chalmers and Dr. Carolyn Begley, the copyright holders of the DEQ-5. Thus, the study protocol meets the requirements of the Declaration of Helsinki.

Translation procedure

Translation process was based on the World Health Organization (WHO) recommendation for instrument translation (23). The translation was carried out by two translators (native Arabic speakers), one of them a professional Moroccan translator with medical background. A preliminary initial Arabic version of the DEQ-5 was generated after reconciliation between these two translators. Two Moroccan teachers of the English language (one of them was knowledgeable about health terminology), working without consulting the original English scale, were responsible for the back translation. No major discrepancies between the forward/backward translation and the original English version were identified resulting on a pre-final Arabic version of the DEQ-5 scale. For content validity concern, both the scientific and cultural relevance of the Arabic translation were examined by a committee of five experts consisting of two optometrists, two ophthalmologists, and one nurse. A Content Validity Index of 1 (CVI=1) was highlighted. Finally, we conducted a pilot study of this Arabic version, with 20 non-clinical participants to check its comprehensibility and applicability. Indeed, no difficulties were reported among these participants, so this final translation was used to test psychometric properties of the Arabic version of the questionnaire.

Scales

Dry Eye Questionnaire-5 (DEQ-5)

It is a short subset of DEQ scale. It contains 5 items that assess the frequency of watery eye, discomfort and dryness within the previous month, and intensity of discomfort and dryness within the end of the day. A 5-point Likert scale was used to respond to the frequency of watery eye, discomfort, and dryness, while a 6-point Likert was used to respond to the intensity of discomfort and dryness. The total score of the DEQ-5 scale is obtained by summing the scores of all the items. Its values vary between 0 to 22 (19). To be able to study the discriminant and concurrent validity of the Arabic version of the DEQ-5 scale, we used the Arabic version of the Ocular Surface Disease Index (Arabic OSDI) scale as a gold standard.

Ocular Surface Disease Index (OSDI) scale

The Arabic version of the OSDI instrument was used to assess symptoms related to dry eye among participants (18). This scale was first developed by the Outcomes Research Group at Allergan Inc (Irvine, California, USA) to have quick estimates of symptoms related to dry eye over the past week. It consists of 12 items grouped into 3 subscales. A subscale encompassing the first 5 items is interpreted as ocular symptoms. It gauges the symptoms of ocular irritation consistent with dry eye disease. The impact of dry eye disease on daily functioning is estimated by the second subscale named vision-related function which includes the 4 items in the middle of the scale. The third subscale measures the degree of influence of environmental triggers by 3 items. To respond to the OSDI scale, participants used a 5-point Likert scale with the options none of the time (0); some of the time (1); half of the time (2); most of the time (3); and all of the time (4). the option "N/A" is used for the items 6 to 12. The overall OSDI score was calculated using the following formula: OSDI= [(sum of scores for all questions answered)×100]/[(total number of questions answered)×4] according to the developers of the scale (24). The overall OSDI score categorized the ocular surface as normal (0-12 points) or as having mild (13-22 points), moderate (23-32 points), or severe (33-100 points) dry eye disease (25). Subsequently to be considered symptomatic for the diagnosis of dry eye requires an OSDI score ≥13 (25).

Statistical analysis

Subject to item ratio is a frequently used method to determine a required sample size for psychometric validation studies, but with various recommendations which range from 2 to 20 subjects per item (26).

Given that the DEQ-5 scale is composed of 5 items, we estimated a sample size of 100 for the current study. Descriptive statistics concerning the participants' demographic characteristics, the mean scores (standard deviation: SD) of DEQ-5 and OSDI scales were calculated. The OSDI and the DEQ-5 scores were normally distributed, with the largest absolute skewness value of .78 (OSDI), and largest kurtosis value of .07 (DEQ-5). Then, the reliability of the DEQ-5 questionnaire was computed with Cronbach α which reflects its internal consistency. Unidimentionality of DEQ-5 scale was checked using two methods. The first consists of the Rash analysis which produces fit statistics (infit and outfit) and reliability and separation coefficients for items/persons of the DEQ-5 questionnaire using jMetrik software version 4.1.1. Secondly an Exploratory Factor Analysis (EFA) was performed on the Jasp program 0.17.1 version by principal axis factoring as a method of extraction and oblimin rotation. Only factors with an eigenvalue greater than 1 and items with factor loading greater than 0.40 were retained. The assessment of factorability was based on the Kaiser–Meyer–Olkin (KMO) test and Bartlett's sphericity test (27,28). Discriminant validity of the DEQ-5 was explored by testing for significant differences in DEQ-5 scores among different categories of dry eye symptom severity as defined by the OSDI score. For this reason, an analysis of variance (ANOVA) with a Tukey post-hoc was carried out. The concurrent validity between DEQ-5 and OSDI (Criterion validity) was examined by the analysis of Pearson's correlation coefficient. To determine the most appropriate cut-off value for DEQ-5 maximizing the sum of sensitivity and specificity, the Receiver Operating Characteristics (ROC) curve was produced. This cut-off will allow us to discriminate between the symptomatic group and the asymptomatic one. The level of concordance between DEQ-5 and OSDI was evaluated by calculating the Cohen Kappa and the Area Under the Curve (AUC) of the ROC curve. A *P*-value less than 0.05 was considered statistically significant.

Results

There were 150 surveys returned, one hundred three valid survey responses were maintained after data cleaning and eliminating invalid responses. The female gender dominated the sample (57.3%). The age distribution was normal, average age of participants was 34.41 year (SD=14.07), range (18-67). Regarding education level, 29.2 % of the participants have completed secondary education, and 69.2% have a university level.

Internal consistency/Reliability

To analyze the reliability and internal consistency of the DEQ-5, Cronbach's alpha was calculated. Cronbach's alpha based on standardized items in the present study was 0.80, suggesting that the scale has a good internal consistency. Furthermore, no negative correlation between items was detected in the correlation matrix (Table 1), and the item-rest correlation ranged from 0.58-0.76, except for item 5 (DEQ-5WAT). Therefore, all items have a good correlation with the scale (Table 2).

Table 1. Pearson's Correlations matrix of the Arabic DEQ-5.

Item †	1	2	3	4
DEQ-5 DIS a	—			
DEQ-5 DIS b	0.505 (*P* < .001)	—		
DEQ-5 DRY a	0.595 (*P* < .001)	0.540 (*P* < .001)	—	
DEQ-5 DRY b	0.467 (*P* < .001)	0.794 (*P* < .001)	0.625 (*P* < .001)	—
DEQ-5 WAT	0.271 (*P* = .006)	0.357 (*P* < .001)	0.058 (*P* = .559)	0.267 (*P* = .006)

†*Abbreviations* for the original DEQ-5 items: DIS: discomfort; DRY: dryness; WAT: watery

Table 2. Item analysis and internal consistency of the Arabic DEQ-5.

Item †	If item dropped	
	Cronbach's α	Item-rest correlation
DEQ-5 DIS a	0.767	0.591
DEQ-5 DIS b	0.691	0.768
DEQ-5 DRY a	0.761	0.586
DEQ-5 DRY b	0.699	0.750
DEQ-5 WAT	0.844	0.296

†*Abbreviations* for the original DEQ-5 items: DIS: discomfort; DRY: dryness; WAT: watery

Discriminant validity and concurrent validity

The mean (SD) OSDI score was 28.95 (18.59); mean (SD) score for asymptomatic, mild, moderate, and severe symptoms were respectively 7.24 (3.99), 17.37 (2.66), 26.74 (2.69) and 50.38 (13.11). while the mean (SD) DEQ-5 score was 7.67 (4.00). The mean (SD) DEQ-5 scores for OSDI categories were as follows: 3.24 (2.23) for asymptomatic group, 7.00 (2.91) for mild group, 7.88 (2.70) for moderate group and 10.53 (3.61) for severe group. To test whether there is a significant difference between these 4 groups as defined by OSDI in terms of DEQ-5 score, we used the one-factor variance test (ANOVA). Thus, preliminary analysis was performed to ensure no violation of the assumptions of normality, homogeneity, and no outliers. Indeed, this test affirmed the existence of significant differences between the groups under study (F=26.20, d=3, P <0.0001) in their DEQ-5 score. To determine which groups are different, we have to carry out a *post-hoc* test with Tukey test for multiple comparisons. The results of this analysis revealed that the only statistically non-significant difference exists between the mild and moderate group (P =0.76); while the differences between the other groups, with respect to their DEQ score, were statistically significant as the P -value varied between 0.000 and 0.007. Consequently, the mild and moderate group can be merged to designate a single group of medium severity of symptoms of dry eyes, which results in 3 homogeneous

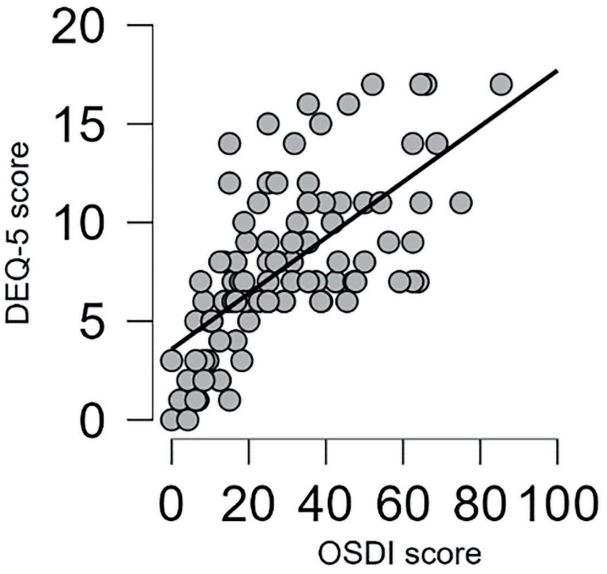

Figure 1. Scatterplot of the correlation between overall OSDI and DEQ-5 questionnaires score.

categories of dry eyes symptoms severity according to their DEQ-5 score. The total number of subjects classified as symptomatic according to the OSDI scale was 82 while 81 individuals were so as stated by the DEQ-5 scale. Additionally, the Pearson correlation coefficient between the total scores of these two questionnaires was r = 0.69 (P <0.0001) (Figure 1). The correlation was also significant between the scores of individuals who were classified as asymptomatic (r =0.48, P =0.4), and those who were classified as symptomatic (r = 0.42, P <0.0001) by the OSDI and the DEQ-5 scales.

Unidimensionality of the DEQ-5 questionnaire

In Rasch analysis, unidimensionality was examined using the item fit mean square statistics. Table 3 illustrates that mean square infit (INFIT MNSQ) and outfit (OUTFIT MNSQ) statistics ranged between 0.7–1.6 and 0.5–2, respectively, with the values between 0.5 and 1.7 mean square considered acceptable (29). Principal component analysis of standard residual was run and generated an unexplained variance in the first contrast or eigenvalue , indicating a value of 1.7 which

Table 3. Rasch Dimensionality measures for DEQ-5.

Item †	INFIT MNSQ	Std. INFIT MNSQ	OUTFIT MNSQ	Std. OUTFIT MNSQ
DEQ-5 DIS a	.78	-1.64	.77	-1.70
DEQ-5 DIS b	.93	-0.42	.80	-1.10
DEQ-5 DRY a	.86	-0.97	.83	-1.11
DEQ-5 DRY b	0.74	-1.85	.59	-2.50
DEQ-5 WAT	1.63	3.79	2.0	4.99

†*Abbreviations* for the original DEQ-5 items: DIS: discomfort; DRY: dryness; WAT: watery. INFIT MNSQ: infit mean square; OUTFIT MNSQ: outfit mean square; Std: standard deviation.

supports the unidimensionality of the DEQ-5 scale (30). Concerning Measurement precision, it was assessed using the items/person-separation statistics. Results shows that item and person separation index was respectively 2.2 and 1.9 while the reliability analysis was 0.8. The minimum recommended level of separation is 2.0 and reliability analysis between 0.8 and 1 is excellent (31).

Moreover, the appropriateness of the data for EFA was assessed using the Kaiser-Meyer-Olkin (KMO) coefficient, which yielded values greater than 0.71 for each item. Besides, Bartlett's Sphericity Test ($\chi 2 = 232.662$, df = 10, $p < 0.001$) indicated that the inter-item correlations were reasonable to conduct an EFA (32). Using the Kaiser-Guttman criterion of an Eigenvalue greater than 1 for each factor, and a factor loading greater than 0.40 for each item (28), only one factor was extracted, with an explained variance of 53.1% (Figure 2).

Sensitivity and specificity of the DEQ-5 questionnaire

The ROC curve was produced to determine the most appropriate cut-off value for DEQ-5 scale maximizing the sum of sensitivity and specificity. According to this approach, the value of the cut-off was 5.5 (sensitivity = 0.95, specificity = 0.85) (Figure 3). The AUC is a global measure of the ability of a DEQ-5 scale used to determine whether or not the symptoms of dry eyes are present. Its value was 0.93 (95 % CI: 0.86 – 0.99) (P <0.0001). The Cohen kappa was used to seek the degree of agreement between OSDI and DEQ-5, its value was 0.79 (P <0.0001).

Discussion

The DEQ-5 is a short, valid, and reliable instrument that subjectively quantifies the frequency and intensity of dry eye symptoms. Effectively, this questionnaire has proven its discriminative performance between patients with and without dry eye (19). This tool also allows to distinguish severe cases suffering from systemic diseases which are related to dry eye such as Sjögren's syndrome. Being part of the diagnosis of dry eye (16), this questionnaire has been used by several researchers to examine symptoms related to dry eyes (33–39). The prevalence of dry eye in Arab countries is 36.4%, 59% and 64% respectively in Lebanon, Palestine, and Jordan (40–42); as measured by the Arabic version of the OSDI scale. Evaluating the prevalence of dry eyes via the Arabic version of the DEQ-5 scale and comparing the results of the two scales is beneficial for better ascertainment of patients suffering from this disease. These patients will subsequently be subject to objective diagnosis of dry eye. The aim of this study was to examine the criterion validity of the Arabic version of the DEQ-5 scale in the Moroccan context for its possible use in Arab communities. Two steps were followed to achieve this goal. The first one which consisted of a back-forward translation into Arabic did not reveal any notable differences between the translators. This led to a consensus on the Arabic version of the DEQ-5 easily. The second step was to determine the psychometric properties of this scale such as its internal consistency, discriminant, and concurrent validity using the

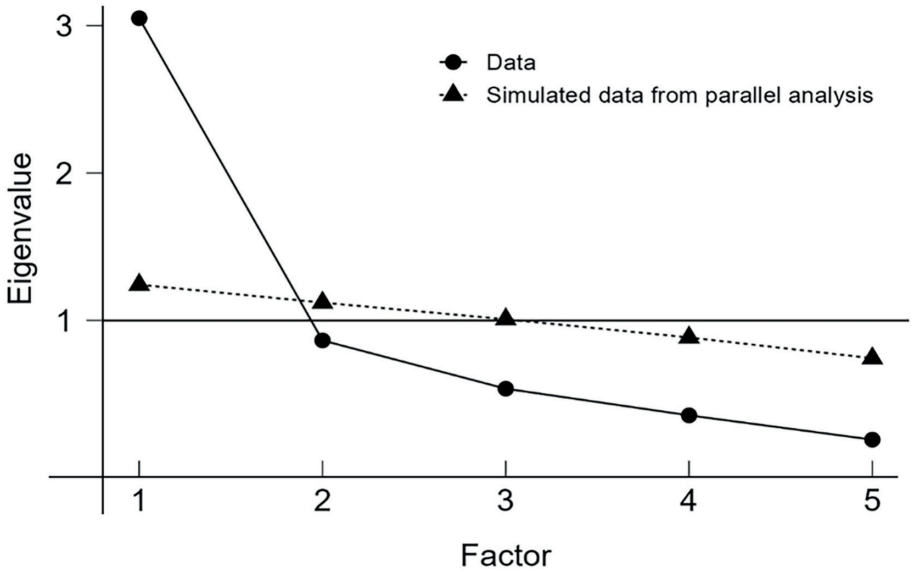

Figure 2. Scree plot visualizing factors with eigenvalue exceeding 1.

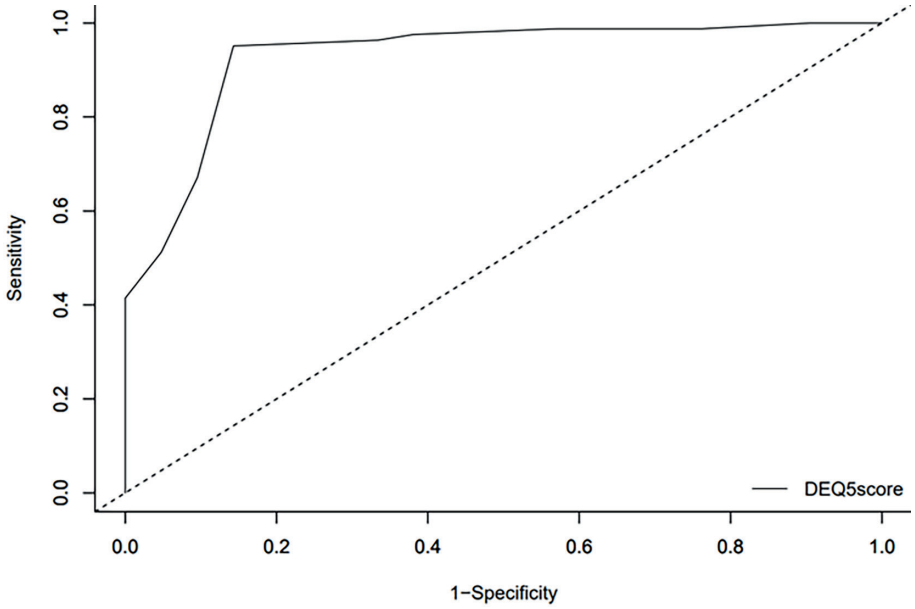

Figure 3. ROC curve showing the area under the curve of DEQ-5 questionnaire (AUC).

valid Arabic version of OSDI as gold standard. The DEQ-5 questionnaire showed good reliability similar to the previously communicated results (21,22,25) as internal consistency reported by Cronbach's alpha revealed a value of 0.8 and all items had a good correlation with the scale. Moreover, symptom assessment is important in the diagnosis and support of patients with dry eye disease. As a result, TFOS DEWS II Diagnostic Methodology report recommended the use of DEQ-5 and OSDI questionnaires as subjective measures of symptoms associated with dry eye (16). In fact, these two scales are interested in the frequency of the symptoms of this disease. Whereas the OSDI is interested in symptoms affecting the vision-related

functioning during the week which precedes the diagnosis. The DEQ -5 is rather sensitive to their intensity during the day and during the month preceding the diagnosis. Even if the DEQ-5 and OSDI do not target exactly the same aspects of dry eye, a linearity between their total scores is obtained, in addition to a significant and high correlation coefficient which supports the good concurrent validity of the DEQ-5. This result is consistent with the findings of previous studies that have studied the correlation between these two questionnaires (25,34,43). Rasch analysis was performed to examine DEQ-5's unidimensionality, measurement precision, and reliability. It has found that all item's fit of DEQ-5 were included in the interval 0.5-1.7 except for the DEQ-5 WAT OUTFIT MNSQ. However, based on the magnitude of the Eigenvalue in the first contrast which was 1.7 the unidimensionality assumption of the DEQ-5 was met and all items of the questionnaire measures underlying traits of dry eye disease. This result is supported by previous work of Ilechie et al. (29) which demonstrated the unidimensionality of the DEQ-5 scale. The items/person measurement precision respected the recommended range, which indicates that the DEQ-5 scale allows good differentiation between participants with different levels of dry eye difficulty. In addition, the result of the EFA affirms the unidimensionality of the DEQ-5 scale by extracting a single factor explaining 53.1% of the variance. ROC curve was also produced. It represents the sensitivity as a function of 1-the specificity (44), the maximum value of sensitivity and specificity was obtained with a threshold of 5.5 which represents a cut-off for the Arabic DEQ-5 scale. The same value was reported by Akuwah et al. in their study and it is comparable to that recommended by Chalmers et al. which takes the value of 6 (19,25). The area under the ROC curve accurately determines the diagnostic/test efficiency in differentiating between patients with and without disease/symptoms (44). Its value was 0.93 in this work, which represents an excellent discriminatory capacity of the Arabic DEQ-5 test. The level of agreement between the Arabic DEQ-5 and the Arabic OSDI scales was examined by the Cohen kappa coefficient; its value was 0.79 confirming a good agreement between these two questionnaires (45).

Conclusion

Overall, this work represents the first validation of the Arabic version of the DEQ-5 tool. We investigated its psychometric properties within a sample of 103 non-clinical Moroccan participants, employing Rash analysis and EFA to investigate its factor structure, and the Arabic version of the OSDI scale as a gold standard. The results confirmed its unidimentionality, reliability, and validity that it makes it applicable to the subjective assessment of DED symptoms in the Arabic-speaking population. Our study must be considered in the light of its limitations which include the non-use of objective dry eye tests such as the measurement of tear film height, fluorescein tear film breakup time, Schirmer's test, lissamine green staining of ocular surface. The online snowball sampling, which is a method that does not allow us to establish the response rate, and the exclusion of participants who wear contact lenses or had eye surgery in the last three months before the survey. These last two limits can affect the scores obtained from the two questionnaires (Arabic DEQ-5 and Arabic OSDI) used. So, in future work, discriminant validity of the Arabic DEQ-5 could be tested by using both the Arabic DEQ-5 and clinical tests to examine the performance of Arabic DEQ-5 in distinguishing between individuals with and without dry eye.

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Ethic Committee: Ethical approval was obtained from the hospital-university ethics committee of Sidi Mohamed Ben Abdellah University (N°16/ 22). All the participants were notified about the aim of the study and had provided electronic informed consent before starting the investigation.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: BS has been involved in the conception and design of the study, acquisition of data, analysis and interpretation of data, and drafting the manuscript; AS has contributed to the conception and design of the study, and acquisition of data; MER has carried out the statistical analysis, interpretation of data, and revising the manuscript; JE has carried out the statistical analysis, interpretation of data, and revising the manuscript; KE has contributed to the conception and design of the study; BZ has contributed to the conception and design of the study, drafting, revising the manuscript critically, and has given the final approval for the paper to be published. All authors read and approved the manuscript.

References

1. Honavar SG. Dry Eye Disease = DED = A Disease Eluding Diagnosis. Indian J Ophthalmol. 2023 Apr;71(4):1059. doi: 10.4103/IJO.IJO_796_23
2. Stapleton F, Alves M, Bunya VY, et al. TFOS DEWS II Epidemiology Report. Ocul Surf. 2017 Jul 1;15(3):334–65. doi: 10.1016/j.jtos.2017.05.003
3. Craig JP, Nichols KK, Akpek EK, et al. TFOS DEWS II Definition and Classification Report. Ocul Surf. 2017 Jul 1;15(3):276–83. doi: 10.1016/j.jtos.2017.05.008
4. Nichols KK, Bacharach J, Holland E, et al. Impact of Dry Eye Disease on Work Productivity, and Patients' Satisfaction With Over-the-Counter Dry Eye Treatments. Invest Ophthalmol Vis Sci. 2016 Jun 6;57(7):2975–82. doi: 10.1167/iovs.16-19419
5. van Tilborg MM, Murphy PJ, Evans KS. Impact of Dry Eye Symptoms and Daily Activities in a Modern Office. Optom Vis Sci. 2017 Jun;94(6):688. doi: 10.1097/OPX.0000000000001086
6. Morthen MK, Magno MS, Utheim TP, et al. The vision-related burden of dry eye. Ocul Surf. 2022 Jan 1;23:207–15. doi: 10.1016/j.jtos.2021.10.007
7. Crane AM, Levitt RC, Felix ER, et al. Patients with more severe symptoms of neuropathic ocular pain report more frequent and severe chronic overlapping pain conditions and psychiatric disease. Br J Ophthalmol. 2017 Feb;101(2):227–31. doi: 10.1136/bjophthalmol-2015-308214
8. Galor A, Britten-Jones AC, Feng Y, et al. TFOS lifestyle: Impact of lifestyle challenges on the ocular surface. Ocul Surf. 2023 Apr 11;28:262–303. https://doi: 10.1016/j.jtos.2023.04.008
9. Asiedu K, Kyei S, Boampong F, et al. Symptomatic Dry Eye and Its Associated Factors: A Study of University Undergraduate Students in Ghana. Eye Contact Lens. 2017 Jul;43(4):262. doi: 10.1097/ICL.0000000000000256
10. Matossian C, McDonald M, Donaldson KE, et al. Dry Eye Disease: Consideration for Women's Health. J Womens Health. 2019 Apr 1;28(4):502–14. doi: 10.1089/jwh.2018.7041
11. Sullivan DA, Rocha EM, Aragona P, et al. TFOS DEWS II Sex, Gender, and Hormones Report. Ocul Surf. 2017 Jul;15(3):284–333. doi: 10.1016/j.jtos.2017.04.001
12. Chan TCY, Chow SSW, Wan KHN, et al. Update on the association between dry eye disease and meibomian gland dysfunction. Hong Kong Med J Xianggang Yi Xue Za Zhi. 2019 Feb;25(1):38–47. doi: 10.12809/hkmj187331
13. Mirza E, Oltulu R, Oltulu P, et al. Dry eye disease and ocular surface characteristics in patients with keratoconus. Saudi J Ophthalmol. 2022 Jul 11;36(1):117–21. doi: 10.4103/sjopt.sjopt_37_21
14. Trattler W, Karpecki P, Rapoport Y, et al. The Prevalence of Demodex Blepharitis in US Eye Care Clinic Patients as Determined by Collarettes: A Pathognomonic Sign. Clin Ophthalmol. 2022 Dec 31;16:1153–64. doi: 10.2147/OPTH.S354692
15. Begley CG, Chalmers RL, Mitchell GL, et al. Characterization of Ocular Surface Symptoms From Optometric Practices in North America. Cornea. 2001 Aug;20(6):610.
16. Wolffsohn JS, Arita R, Chalmers R, et al. TFOS DEWS II Diagnostic Methodology report. Ocul Surf. 2017 Jul 1;15(3):539–74. doi: 10.1016/j.jtos.2017.05.001
17. Okumura Y, Inomata T, Iwata N, et al. A Review of Dry Eye Questionnaires: Measuring Patient-Reported Outcomes and Health-Related Quality of Life. Diagnostics. 2020 Aug;10(8):559. doi: 10.3390/diagnostics10080559
18. Bakkar MM, El-Sharif AK, Al Qadire M. Validation of the Arabic version of the Ocular Surface Disease Index Questionnaire. Int J Ophthalmol. 2021;14(10):1595–601. doi: 10.18240/ijo.2021.10.18
19. Chalmers RL, Begley CG, Caffery B. Validation of the 5-Item Dry Eye Questionnaire (DEQ-5): Discrimination across self-assessed severity and aqueous tear deficient dry eye diagnoses. Contact Lens Anterior Eye. 2010 Apr 1;33(2):55–60. doi: 10.1016/j.clae.2009.12.010
20. Martinez JD, Galor A, Amescua G, et al. Transcultural validation of the 5-Item Dry Eye Questionnaire for the Mexican population. Int Ophthalmol. 2019 Oct;39(10):2313–24. doi: 10.1007/s10792-018-01068-3
21. Goya MC, Traipe L, Bahamondes R, et al. Adaptation culturally and linguistically to the Chilean population and validation the Dry Eye Questionnaire 5. Arch Soc Espanola Oftalmol. 2023 Mar 22;S2173-5794(23)00034-8. doi: 10.1016/j.oftale.2023.01.004
22. Gross LG, Pozzebon ME, Favarato AP, et al. Translation and validation of the 5-Item Dry Eye Questionnaire into Portuguese. Arq Bras Oftalmol. 2022 Nov 4:S0004-27492022005011218. doi: 10.5935/0004-2749.2022-0197
23. Sousa VD, Rojjanasrirat W. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline:

Validation of instruments or scales. J Eval Clin Pract. 2011 Apr;17(2):268–74. doi: 10.1111/j.1365-2753.2010.01434.x
24. Schiffman RM, Christianson MD, Jacobsen G, et al. Reliability and Validity of the Ocular Surface Disease Index. Arch Ophthalmol. 2000 May 1;118(5):615–21. doi:10.1001/archopht.118.5.615
25. Akowuah PK, Adjei-Anang J, Nkansah EK, et al. Comparison of the performance of the dry eye questionnaire (DEQ-5) to the ocular surface disease index in a non-clinical population. Contact Lens Anterior Eye J Br Contact Lens Assoc. 2022 Jun;45(3):101441. doi: 10.1016/j.clae.2021.101441
26. Anthoine E, Moret L, Regnault A, et al. Sample size used to validate a scale: a review of publications on newly-developed patient reported outcomes measures. Health Qual Life Outcomes. 2014 Dec 9;12:2. doi: 10.1186/s12955-014-0176-2
27. Hair JF, Babin BJ, Black WC, et al. Multivariate Data Analysis. Cengage; 2019. 813 p.
28. Gabe KT, Jaime PC. Development and testing of a scale to evaluate diet according to the recommendations of the Dietary Guidelines for the Brazilian Population. Public Health Nutr. 2019 Apr;22(5):785-796. doi: 10.1017/S1368980018004123
29. Ilechie A, Mensah T, Abraham CH, et al. Assessment of four validated questionnaires for screening of dry eye disease in an African cohort. Contact Lens Anterior Eye. 2022 Apr;45(2):101468. doi: 10.1016/j.clae.2021.101468
30. Pucker AD, Dougherty BE, Jones-Jordan LA, et al. Psychometric Analysis of the SPEED Questionnaire and CLDEQ-8. Invest Ophthalmol Vis Sci. 2018 Jul 5;59(8):3307–13. doi: 10.1167/iovs.18-24016
31. Aryadoust V, Ng LY, Sayama H. A comprehensive review of Rasch measurement in language assessment: Recommendations and guidelines for research. Lang Test. 2021 Jan 1;38(1):6–40. doi: 10.1177/0265532220927487
32. Taherdoost H, Sahibuddin S, Jalaliyoon N. Exploratory factor analysis; concepts and theory. Adv Appl Pure Math. 2022;27:375–82.
33. Pult H, Wolffsohn JS. The development and evaluation of the new Ocular Surface Disease Index-6. Ocul Surf. 2019 Oct;17(4):817–21. doi: 10.1016/j.jtos.2019.08.008
34. Chatterjee S, Agrawal D, Chaturvedi P. Ocular Surface Disease Index© and the five-item dry eye questionnaire: A comparison in Indian patients with dry eye disease. Indian J Ophthalmol. 2021 Sep;69(9):2396–400. doi: 10.4103/ijo.IJO_3345_20
35. Dana R, Meunier J, Markowitz JT, et al. Patient-Reported Burden of Dry Eye Disease in the United States: Results of an Online Cross-Sectional Survey. Am J Ophthalmol. 2020 Aug 1;216:7–17. doi: 10.1016/j.ajo.2020.03.044
36. Tonkerdmongkol D, Poyomtip T, Poolsanam C, et al. Prevalence and associated factors for self-reported symptoms of dry eye among Thai school children during the COVID-19 outbreak. PLOS ONE. 2023 Apr 24;18(4):e0284928. doi: 10.1371/journal.pone.0284928
37. Kim DW, Seo JH, Lim SH. Evaluation of ocular surface disease in elderly patients with glaucoma: expression of matrix metalloproteinase-9 in tears. Eye. 2021 Mar;35(3):892–900. doi: 10.1038/s41433-020-0993-y
38. Han G, Lim DH, Yoo YS, et al. Transcutaneous Electrical Stimulation for the Prevention of Dry Eye Disease after Photorefractive Keratectomy. Ophthalmol Sci. 2022 Nov 2;3(2):100242. doi: 10.1016/j.xops.2022.100242
39. Caffery B, Srinivasan S, Reaume CJ, et al. Prevalence of dry eye disease in Ontario, Canada: A population-based survey. Ocul Surf. 2019 Jul 1;17(3):526–31. doi: 10.1016/j.jtos.2019.02.011
40. Bakkar MM, Shihadeh WA, Haddad MF, et al. Epidemiology of symptoms of dry eye disease (DED) in Jordan: A cross-sectional non-clinical population-based study. Contact Lens Anterior Eye. 2016 Jun 1;39(3):197–202. doi: 10.1016/j.clae.2016.01.003
41. Sherry A, Aridi M, Ghach W. Prevalence and risk factors of symptomatic dry eye disease in Lebanon. Contact Lens Anterior Eye J Br Contact Lens Assoc. 2020 Aug;43(4):355–8. doi: 10.1016/j.clae.2019.08.001
42. Shanti Y, Shehada R, Bakkar MM, et al. Prevalence and associated risk factors of dry eye disease in 16 northern West bank towns in Palestine: a cross-sectional study. BMC Ophthalmol. 2020 Jan 13;20:26. doi: 10.1186/s12886-019-1290-z
43. Simpson TL, Situ P, Jones LW, et al. Dry Eye Symptoms Assessed by Four Questionnaires. Optom Vis Sci. 2008 Aug;85(8):E692. doi: 10.1097/OPX.0b013e318181ae36
44. Hoo ZH, Candlish J, Teare D. What is an ROC curve? Emerg Med J. 2017 Jun;34(6):357–9. doi: 10.1136/emermed-2017-206735
45. McHugh ML. Interrater reliability: the kappa statistic. Biochem Medica. 2012 Oct 15;22(3):276–82.

Correspondence:
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Samira Bouazza
Laboratory of Epidemiology and Research in Health Sciences, Faculty of Medicine and Pharmacy, Sidi Mohamed Ben Abdellah University, Fez, Morocco
E-mail: samira.bouazza@usmba.ac.ma
ORCID: 0000-0002-2273-1803