



The validity and reliability of the Arabic version of the ocular surface disease index (OSDI) questionnaire in a sample of the Gazan population: a study from Palestine

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Received: 13 February 2022 / Accepted: 11 September 2022
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Abstract

Purpose To develop an Arabic version of OSDI for the Gazan population.

Methods A cross-sectional observational study was conducted using a convenience sample technique. The translation procedure included five stages: forward translation, revision of translation, backward translation, refinement of translation, and a final test of the pre-final version. The final sets of questionnaires were constructed using an online JotForm platform. The online platform was chosen to automatically calculate the questionnaire's final overall score. Overall, 260 participants were instructed to fill out the English and

the Arab-OSDI version twice to conduct the reliability of the translated version and repeatability evaluation.

Results The mean age of the participants was 33.45 ± 11.74 years old. Cronbach's alpha for all items was greater than 0.80, except for the "blurred vision" and "deteriorating vision" items (0.77 and 0.74, respectively). The mean overall score difference between the English-OSDI and Arab-OSDI was 0.86 based on the Bland–Altman chart. For repeatability, no significant difference in the overall scores between the two repeats of the Arab-OSDI ($p = 0.632$). The Arab-OSDI overall score (sessions 1 and 2) has a clinical difference (bias) of 0.21. Using the varimax rotation method, only three factors (ocular symptoms, vision-related function, and environmental triggers) had eigenvalues greater than one in the structure of the Arab-OSDI.

Conclusion The Arab-OSDI is an appropriate, reliable, and repeatable tool for the determination of dry eye symptoms, ocular discomfort, and quality of life in the Gazan population. This version could remove the language barrier in answering OSDI items more easily.

Keywords OSDI questionnaire · Arabic version · Dry eye syndrome · Ocular discomfort

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Introduction

Previous literature has revealed that the ocular surface disease index (OSDI) questionnaire is a valid tool that is commonly used to screen populations for the assessment of dry eye disease (DED) [1, 2]. Similarly, studies demonstrated that the OSDI is applied to evaluate and measure the severity of dry eye symptoms and the impact on the functional quality of life in dry eye cases [3, 4]. Currently, the questionnaire is one of the most common instruments for diagnosing dry eye syndrome with comorbidities such as glaucoma, allergic conjunctivitis, blepharitis, and bronchial asthma [5–10]. The OSDI was shown to have a good test–retest reliability, and Rasch analysis further demonstrated its psychometric properties and concurrent validity [3, 4, 8]. Comparative studies found good correlations between the OSDI and other items on DED [National Eye Institute Visual Function Questionnaire (NEIVFQ-25), McMonnies questionnaire, Dry Eye Questionnaire (DEQ), Subjective Evaluation of Symptoms of Dryness (SESOD), and Ocular Comfort Index (OCI)]. Indeed, the survey has been accepted as a dry eye item and was applied to find the possible risk factors of dry eye symptoms across the globe [11]. The questionnaire was translated and validated in many languages including Portuguese [12], Spanish [13], Bahasa Malaysia [14], Persian [1], Chinese [15], Filipino [16], Japanese [17] and classical Arabic [18]. In Palestine, Shanti and co-workers revealed that 71% of a West Bank sample population was symptomatic [19]. In that report, the frequency of dry eye was recorded based on the original OSDI overall score. Therefore, the purpose of our report was to validate the translation of the OSDI to the Arabic version and its cultural adaptation in Palestine. Using the Arab-OSDI, it would be beneficial to apply this valuable instrument for clinical and research purposes among subjects with dry eye disease in Palestine.

Subjects and methods

Ethical approval

The validation study was approved by the Palestinian Health Research Council Helsinki committee (PHRC/HC/883/21, dated April 05, 2021). The participants

were contacted through an online messaging platform (WhatsApp), phone calls, and text messages to ask for their details and then fill out the consent, original, and translated Arab-OSDI online.

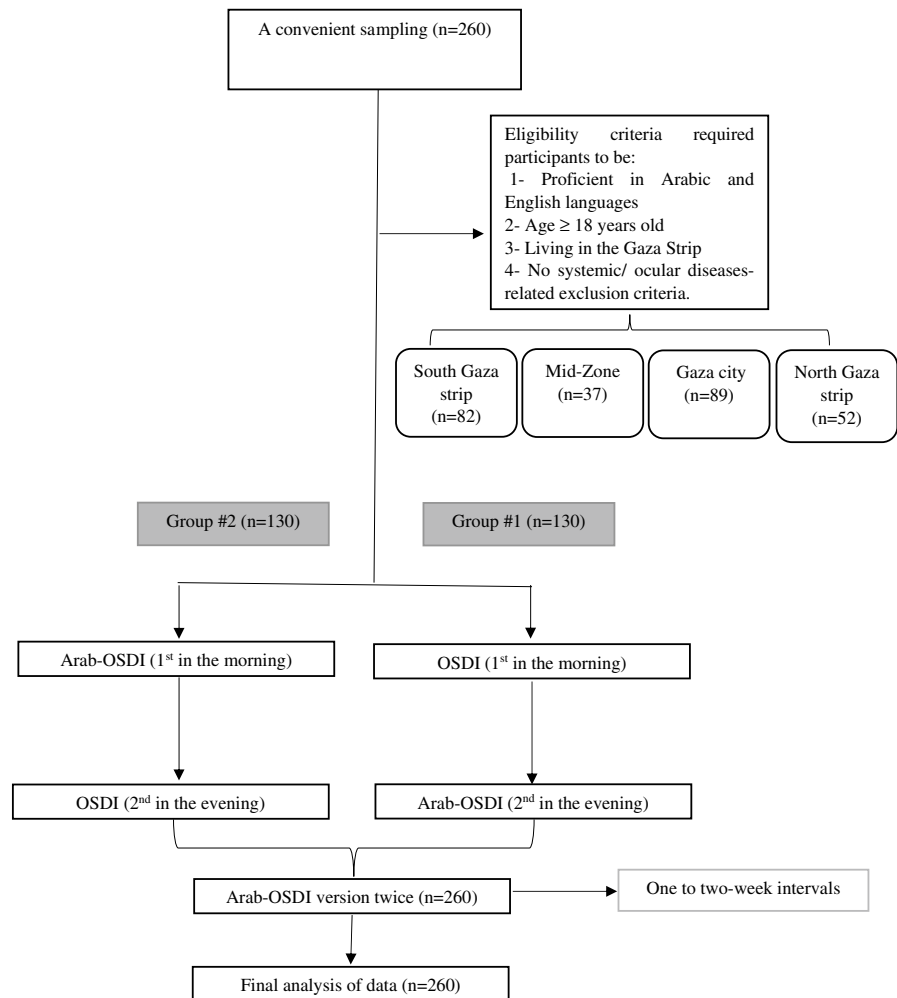
Study design

A cross-sectional observational study was carried out by implementing a convenient sampling technique. Eligibility criteria included those who were proficient in Arabic and English languages, Palestinian graduates and undergraduates who passed the Arabic and English papers in their secondary education certificate examination in Palestine (Tawjihi) and living in the Gaza Strip with age ≥ 18 years old. There were no systemic/ocular disease-related exclusion criteria. The number of participants chosen in each province was based on the proportions of the population living in the province. The maximum sample size is the number of items $\times 20$, as described in the literature [20]. Therefore, the appropriate sample size is 260 participants for the four provinces. A total participant of 89 (34.2%) Gaza City, 37 (14.2%) Mid-Zone, 52 (20.0%) North Gaza strip, and 82 (31.5%) South Gaza strip was included (Fig. 1). This study was conducted between June and November 2021. Non-Palestinians were excluded.

Development of Arab-OSDI version

The Arabic version of OSDI was designed similarly to the original English version. It consists of 12 questions in three subscales “ocular symptoms” (5 questions), “vision-related” (3 questions), and “environmental triggers” (3 questions). Each question has the same five Likert-type response options ranging from Never (0) to Always (4). The Arab-OSDI version was developed adhering to the previous guidelines [21, 22]. The methodology of the study involved several steps as follows (Fig. 2):

1. Forward translation of the OSDI from English to Arabic version was conducted independently by Palestinian medical translators and non-medical translators.
2. Revision of both Arabic translations was carried out by a committee of three bi-lingual Palestinian ophthalmologists and two professional Palestin-

Fig. 1 Flow diagram of Arab-OSDI study

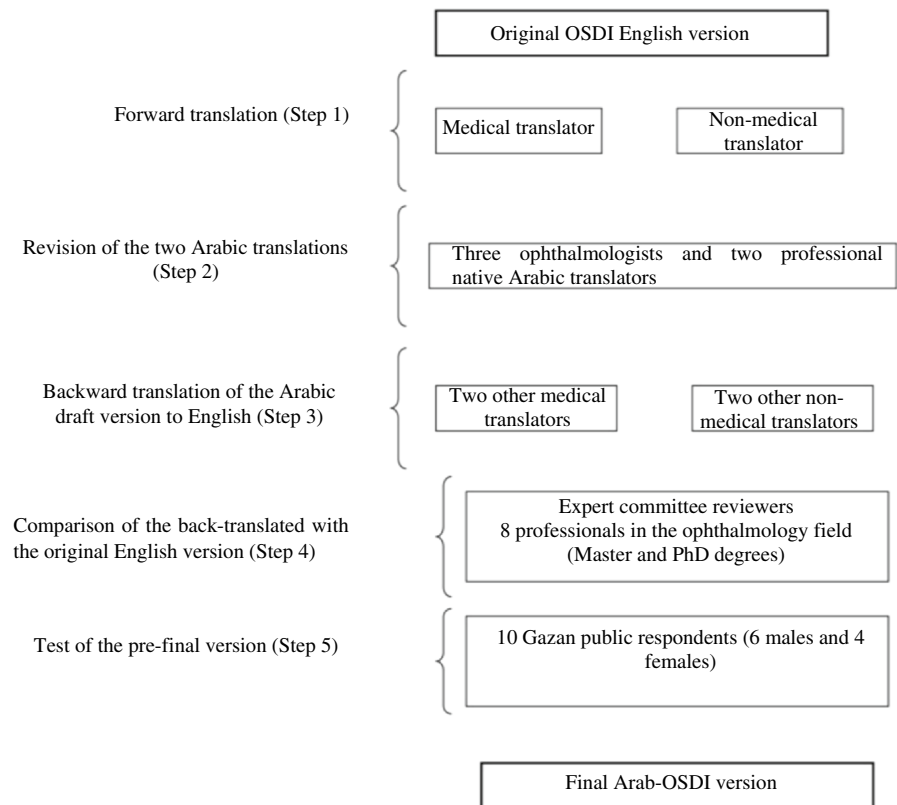
ian dialect translators to produce a second draft of Arab-OSDI.

3. Backward translation of the Arab-OSDI draft was conducted by two other Palestinian medical translators and two other non-medical translators, who were masked to the original version.
4. The backward translation of the Arab-OSDI draft was compared with the original version to determine any inconsistencies, which was revised by eight professionals in the ophthalmology field (Master's and PhD degree holders).
5. A test of the pre-final version was done on ten Gazan public respondents (6 males and 4 females) to check their understanding and interpretation of the survey. Based on the findings of the pre-test evaluation, minor modification of the "instructions, category responses and items" of

the Arab-OSDI version was made, as revealed in Table 1.

Reliability and repeatability of the Arab-OSDI

For the reliability test, all participants were required to fill out both the OSDI and the Arab-OSDI versions. The research team randomly allocated them to two groups (#1 and #2). Participants in Group #1 ($n=130$) began with the original version followed by Arab-OSDI, while the participants in Group #2 ($n=130$) completed the Arab-OSDI followed by the original version. The first session was carried out in the morning, while the second session was held in the evening. This was to avert participants from recalling the first reported responses. The final sets

Fig. 2 Validation and reliability of Arab-OSDI version**Table 1** List of misunderstood instructions/category responses/items of the Arab-OSDI version into English

Instructions/category responses/items	Refinement translation problem (s)	Solution (s)
Instruction	Patient is uncommon word in clinical research studies	Revised to participant/candidate (create data collection)
Category responses	Lack of understanding of terms all of the time, most of the time, half of the time, and some of the time in the pre-final version	These were clarifying into Arabic language that meant always, often, sometimes, and rarely
Instruction	Use a phrase of experienced patient to have a disorder is uncommon in Palestine	Revised to suffer (A case to feel discomfort)
Item 2	Sand wording was unclarified in the Palestinian culture	Grittiness phrasing is a main chief complaint in the Gazan eyes
Item 5	When backward translation of the Arabic draft version to English, the phrase poor vision became low vision, which would deliver amendment to the direction and meaning of the item	The item poor vision was expressed into a phrase in Gazan that meant deteriorating vision
Abbreviations	ATM: Automated teller machines TV: Television	
Instruction	Uncomfortable phrase is less relevant in the cases feel pain	Revised to discomfort (When they are in tired situations)

of questionnaires were constructed using an online platform (<http://www.jotform.com>). The online platform was chosen to calculate the OSDI final score automatically and make it more accessible for dissemination. To investigate the repeatability, a sample ($n=260$) filled out the Arab-OSDI again within one to two-week intervals.

Data analysis

Microsoft Excel and SPSS software v.22 were used to analyze the data. The baseline features for the sample population and individual items for the Arab-OSDI version were carried out by applying descriptive statistics. Values were given as numbers or percentages, means and/or standard deviations or median or skewness, and minimum or maximum. Nonparametric (Mann–Whitney test) was used to compare the Arab-OSDI overall score and sex, and Arab-OSDI overall score and marital status. Kruskal–Wallis test was used to evaluate the associations between Arab-OSDI overall score and each of the independent variables (education level, employment status, and place of residence). The Spearman correlation was conducted to evaluate the correlation between the Arab-OSDI overall score and age. A reliability test for the Arab-OSDI was carried out using Cronbach's alpha coefficient test, inter-item correlation, Bland–Altman plot, and the Ladder plot. In addition, a repeatability test was conducted by applying the coefficient of repeatability, coefficient of variation, differences, Bland–Altman plot, a scatter plot, scree plot, and the varimax rotated factor. Differences between the original and Arab-OSDI items and between Arab-OSDI (session-1 and session-2) were evaluated using a nonparametric test (Wilcoxon signed-rank test).

Results

Descriptive data and subject's characteristics

Overall, 260 participants filled out the questionnaires, including 145 males, 163 married, 100 subjects up to bachelor degree, and 89 individuals living in Gaza City, Palestine. Regarding employment status, 121 participants (61.9%) were employed, while 139 participants (38.1%) were not working (students, housewives, unemployed, or retired). The mean age of

the participants was 33.45 ± 11.74 years old. Association between the participants' characteristics and Arab-OSDI overall score is depicted in Table 2. The Arab-OSDI overall score did not differ with sex or marital status ($p > 0.05$). In addition, there was no influence of education level, employment status, or place of residence on the Arab-OSDI overall score. Lastly, no significant univariate relationship was reported between age and Arab-OSDI overall score ($r = -0.034$; $p = 0.580$). The minimum, maximum, mean score, standard deviation, skewness, and kurtosis of single items included in the Arabic version of the OSDI is illustrated in Table 3. The lowest mean score was for the item "deteriorating vision" whereas the highest was for the item "discomfort or sensitivity due to light exposure." All of the items demonstrated positive skewness. For kurtosis, the variables were not normally distributed since they ranged from -0.02 to 2.58 . Based on the skewness and kurtosis results, the data was non-normality distributed.

The reliability of the Arab-OSDI

The median (interquartile range) of single item and subscale scores of the original and Arab-OSDI versions are depicted in Table 4. The results demonstrated that Cronbach's alpha (α) was above 0.8 for all items except "blurred vision" and "deteriorating vision" (0.77 and 0.74, respectively). The internal consistency revealed a Cronbach's α value for "ocular symptoms" (items 1–5) was 0.84, "vision-related function" (items 6–9) was 0.88, and "environmental factor stimuli of dry eye symptoms" (items 10–12) were 0.90 (Table 5). Item number 5 and subscale 3 (items 10–12) were significantly different between the original and Arab-OSDI based on the nonparametric Wilcoxon signed-rank tests. However, the medians of item number 5 and subscale 3 had the same values in both versions of the questionnaires. The Bland–Altman chart reveals that the mean overall score difference between the OSDI and Arab-OSDI was 0.86. As listed in Fig. 3, the coefficient of reliability (CoR) was ± 21.81 , with an upper confidence limit (UCL) of 22.67 and a lower confidence limit (LCL) of -20.84 in a numerical score ranging from 0 to 100. The internal consistency indices were also expressed by a ladder plot, which displayed a slight difference between the overall mean score of a single item when

Table 2 Median Arab-OSDI overall score according to Gazan participants characteristics

Sociodemographic variables	Number of participants	Percentage (%)	Median (IQR) Arab-OSDI overall score	<i>p</i> value
<i>Sex^a</i>				
Male	145	55.8	19.44(27.08)	0.400
Female	115	44.2	25.00(29.58)	
<i>Marital status^a</i>				
Single	97	37.3	23.00(25.00)	0.332
Married	163	62.7	19.44(28.41)	
Divorced	0	0.0		
Widow	0	0.0		
<i>Education level^b</i>				
Secondary school	33	12.7	20.83(42.17)	0.583
Bachelor	127	48.8	19.44(25.69)	
Master	44	16.9	27.18(31.87)	
Doctor of Philosophy	50	19.2	22.83(28.98)	
Others	6	2.3	24.75(35.09)	
<i>Employment status^b</i>				
Student	47	18.1	20.83(31.25)	0.751
Housewife	6	2.3	32.29(12.64)	
Employee	118	45.4	23.96(30.68)	
Self-employed	43	16.5	16.67(19.13)	
Not working	42	16.2	22.36(27.60)	
Retired	4	1.5	27.09(26.04)	
<i>Place of residence^b</i>				
Gaza City	89	34.2	22.73(26.78)	0.789
Middle area	37	14.2	27.08(27.14)	
North Gaza Strip	52	20.0	17.43(27.50)	
South Gaza Strip	82	31.5	20.64(29.42)	
<i>Age^c (in years)</i>			Correlation coefficient	
Median	31		−0.034	0.580
Mean	33.45			
Standard deviation	11.74			
Minimum	18			
Maximum	78			

Values were given as number or percentage
^amean (standard deviation) or median and minimum or maximum ^bComparison of medians (interquartile ranges) was carried out applying the nonparametric (Mann–Whitney and Kruskal–Wallis) tests ^{a,b}The Spearman correlation was recorded to evaluate the linear correlation between the age and Arab-OSDI overall score ^c(A value of *p* less than 0.05 was reported significant). *IQR* interquartile ranges

comparing the original OSDI and the Arab-OSDI version (Fig. 4).

The repeatability of the Arab-OSDI

All participants from four sites (145 males and 115 females) were instructed to fill out the 12 items of Arab-OSDI twice. The second session was conducted after one to 2 weeks. The results demonstrated no significant differences in the single items, subscale, and overall scores between the two repeats of the Arab-OSDI, except for item 3, item 4, item 5, and item

10 (Tables 6 and 7). However, item 3 “Pain or Irritation and Congestion in the Eyes,” item 4 “Blurred Vision,” item 5 “Deteriorating Vision,” and item 10 “Stormy Weather” had identical medians (interquartile range) for session 1 and session 2 of the questionnaire. The Arab-OSDI overall score (sessions 1 and 2) for each Gazan participant is depicted in Fig. 5. The Arab-OSDI overall score (sessions 1 and 2) was clinically different, with a bias of 0.21. This conforms to the scatter plot, illustrating a positive correlation in the Arab-OSDI overall score between the two sessions ($r=0.785$; $p<0.05$) (Fig. 6).

Table 3 Descriptive statistics of single item for the Arab-OSDI version

Items	Min	Max	Mean	SD	Skewness	Kurtosis
Arab-OSDI 1. Discomfort or sensitivity due to light exposure?	0.00	4.00	1.51	1.11	0.28	−0.572
Arab-OSDI 2. Feeling of a foreign body or grittiness in the eyes?	0.00	4.00	1.14	0.98	0.65	0.094
Arab-OSDI 3. Pain or irritation and congestion in the eyes?	0.00	4.00	1.14	0.96	0.49	−0.022
Arab-OSDI 4. Blurred vision?	0.00	3.00	0.86	0.83	0.52	−0.703
Arab-OSDI 5. Deteriorating vision?	0.00	3.00	0.43	0.72	1.73	2.581
Arab-OSDI 6. Reading?	0.00	4.00	0.77	1.01	1.32	1.171
Arab-OSDI 7. Night driving?	0.00	4.00	0.58	0.86	1.51	1.861
Arab-OSDI 8. Using digital devices like computer or automated teller machines (ATM)?	0.00	4.00	1.05	1.10	0.89	0.108
Arab-OSDI 9. Watching television (TV)?	0.00	4.00	0.82	0.89	0.95	0.453
Arab-OSDI 10. Stormy weather?	0.00	4.00	0.87	1.03	0.97	0.082
Arab-OSDI 11. Dry places (with low humidity)?	0.00	4.00	1.25	1.15	0.56	−0.701
Arab-OSDI 12. Air-conditioned places?	0.00	3.00	0.91	0.96	0.66	−0.697

Items scores ranging from 0 (never) to 4 (always). *Min* minimum, *Max* maximum, *SD* standard deviation

Table 4 Reliability test of single item scores of the original and Arab ocular surface disease index questionnaires

Items	Median (IQR)		Cronbach's Alpha	Inter-item correlation	<i>p</i> value
	OSDI	Arab-OSDI			
Item 1	1.00 (1.00)	1.00 (1.00)	0.87	0.77	0.187
Item 2	1.00 (2.00)	1.00 (2.00)	0.85	0.74	0.930
Item 3	1.00 (2.00)	1.00 (2.00)	0.82	0.70	0.399
Item 4	1.00 (1.00)	1.00 (1.00)	0.77	0.62	0.412
Item 5	0.00 (1.00)	0.00 (1.00)	0.74	0.59	0.008
Item 6	1.00 (1.00)	0.00 (2.00)	0.83	0.72	0.990
Item 7	0.00 (1.00)	0.00 (1.00)	0.88	0.79	0.456
Item 8	1.00 (2.00)	1.00 (2.00)	0.88	0.79	0.141
Item 9	1.00 (1.00)	1.00 (2.00)	0.84	0.73	0.151
Item 10	1.00 (1.00)	1.00 (2.00)	0.88	0.79	0.196
Item 11	1.00 (2.00)	1.00 (2.00)	0.87	0.78	0.152
Item 12	1.00 (1.00)	1.00 (2.00)	0.85	0.74	0.095

Data in bold indicate statistical significance at $p < 0.05$

OSDI ocular surface disease index, *IQR* interquartile ranges

A value of p (Wilcoxon signed-rank test) less than 0.05 was reported significant

Factor Analysis of the Arab-OSDI

In the structure of the Arab-OSDI, as depicted in the scree plot, only three factors (subscales) had eigenvalues greater than one. Our three main subscales exist had values of subscale-1 (6.47), subscale-2 (1.27),

and subscale-3 (1.01), which explained 72.92% of the total variance (Fig. 7). Using the varimax rotation technique, all items were known and clustered into individual factors in the absence of cross-loading items (Table 8). The item with the lowest value (0.544) was item 12, “air-conditioned places,” whereas the highest value (0.909) was item 1 and item 2, “discomfort or sensitivity due to light exposure” and “feeling of a foreign body or grittiness in the eyes,” respectively.

Discussion

This study demonstrates the development of Arab-OSDI version and its cultural adaptation in Palestine. Our research team designed the Arab-OSDI structure to be similar to the original English version in accordance with the previous guidelines [21–24]. Although Palestine has a superior adult literacy rate of 97% compared to the global rate of 91% [25, 26], the estimation of ocular symptoms, vision-related functions, and environmental triggers might be more accurate using an Arab version of OSDI. Thus, the current study develops the Arab-OSDI in a standard language via an online messaging platform. In this study, the Cronbach's alpha coefficient of the Arab-OSDI overall score was 0.88, each subscale was between 0.84 and 0.90, and single item ranged from 0.74 to 0.88. Previous study [27] reported that an alpha value

Table 5 Internal consistency of three subscales of the original and Arab ocular surface disease index questionnaires

Subscale	Median (IQR)		Cronbach's Alpha	Inter-item correlation	<i>p</i> value
	OSDI	Arab-OSDI			
Ocular symptoms (subscale1)	5.00 (5.00)	5.00 (5.00)	0.84	0.72	0.733
Change in functional quality of vision (subscale2)	3.00 (4.00)	2.00 (5.00)	0.88	0.79	0.817
Environmental factors stimuli of DE (subscale3)	3.00 (3.00)	3.00 (4.00)	0.90	0.83	0.027

Data in bold indicate statistical significance at $p < 0.05$

OSDI ocular surface disease index, IQR interquartile ranges, DE dry eye

A value of p (Wilcoxon signed-rank test) less than 0.05 was considered significant

Fig. 3 Bland–Altman plot for clinical agreement between the OSDI and Arab-OSDI overall score showed a clinical difference (bias) of 0.86 unit

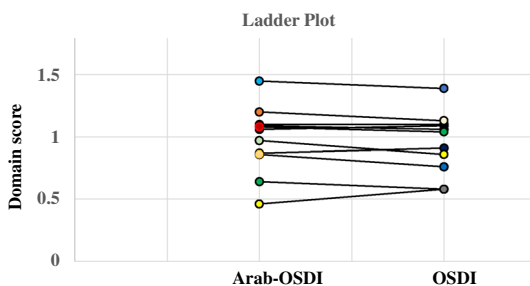
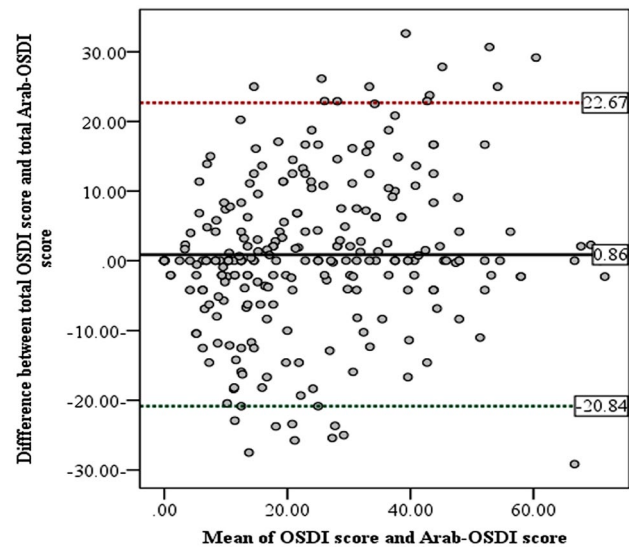


Fig. 4 Ladder plot of internal reliability revealing the difference between the overall mean score of single item in Arab-OSDI and OSDI

greater than 0.7 is satisfactory. Therefore, the findings indicate that the level of reliability of the Arab-OSDI version is desirable. The internal consistency range in this descriptive study is in agreement with

many studies, including Farsi, Bahasa Malaysia, and Japanese versions [1, 14, 17]. Our data noted a significant difference in item 5 and subscale-3 values between the original and Arab-OSDI versions. This may be due to the minor disagreement between the forward translation, backward translation, and the original version, as shown in Table 1. The outcomes may vary from two coping items because of the different cultures, societies, nationalities, and languages [20, 23]. Further, other studies also found that item 5 “poor vision,” is associated with visual symptoms and is very difficult to fully understand [18, 28]. The Bland–Altman chart and ladder plot also illustrate good reliability between the two tools. Our version was comparable to Aziimah et al. [14], who validated a Bahasa Melayu version of OSDI in Malaysian participants. In our study, no difference in overall score between the two sessions. However, a significant difference in item 3, item 4, item 5, and item 10 were

Table 6 The repeatability of the single item in Arab-OSDI

Arab-OSDI items	Mdn score (IQR) session 1	Session2	CoV	CoR	df	<i>p</i> value
Item 1	1.0 (1.0)	1.0 (1.0)	0.03	0.46	0.004	0.71
Item 2	1.0 (2.0)	1.0 (2.0)	0.007	0.24	−0.008	0.16
Item 3	1.0 (2.0)	1.0 (2.0)	0.03	0.49	−0.03	0.005
Item 4	1.0 (1.0)	1.0 (1.0)	0.03	0.52	−0.03	0.003
Item 5	0.0 (1.0)	0.0 (1.0)	0.05	0.60	−0.05	0.001
Item 6	1.0 (2.0)	1.0 (2.0)	0.05	0.65	−0.012	0.41
Item 7	0.0 (1.0)	1.0 (1.0)	0.07	0.73	−0.004	0.76
Item 8	1.0 (2.0)	1.0 (2.0)	0.04	0.54	−0.004	0.74
Item 9	1.0 (2.0)	1.0 (2.0)	0.03	0.48	−0.012	0.26
Item 10	1.0 (2.0)	1.0 (2.0)	0.05	0.64	−0.04	0.003
Item 11	1.0 (2.0)	1.0 (2.0)	0.03	0.47	−0.012	0.26
Item 12	1.0 (2.0)	1.0 (2.0)	0.04	0.54	0.004	0.74

Data in bold indicate statistical significance at $p < 0.05$

OSDI ocular surface disease index, *IQR* interquartile range, *Mdn* median, *CoV* coefficient of variation, *CoR* coefficient of repeatability, *df* difference

A value of p (Wilcoxon signed-rank test) less than 0.05 was considered significant

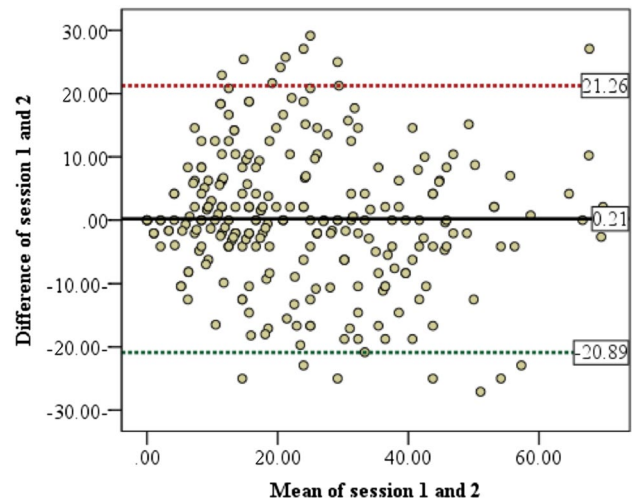
Table 7 Comparison of three subscales and Arab-OSDI overall score between two sessions

Variable	Session 1 ($n=260$) (median(IQR))	Session 2 ($n=260$) (median(IQR))	<i>p</i> value
Total subscale 1	5.00 (5.00)	5.00 (5.00)	0.915
Total subscale 2	2.00 (5.00)	2.00 (5.00)	0.885
Total subscale 3	3.00 (4.00)	2.00 (5.00)	0.267
Arab-OSDI overall score	20.83 (20.83)	19.79 (26.56)	0.632

DE dry eye, *IQR* interquartile ranges

A value of p (Wilcoxon signed-rank test) less than 0.05 was considered significant;

Fig. 5 Bland–Altman plot for clinical agreement between the Arab-OSDI overall score (session 1 and 2) revealed a clinical difference (bias) of 0.21 unit ($r=0.785$; $p<0.05$)



found for both repeats. This could be because the series of items were related to external factors such as job and weather, contributing to the slight variation of dry eye symptoms noted during a short interval [29].

Results of the Gazan participants were also used to investigate the repeatability of the Arab-OSDI.

Recently, Bakkar et al. [18] reported another Arabic version of the OSDI. The researchers conducted

Fig. 6 A scatter plot of test–retest repeatability of the Arab-OSDI overall obtained from 260 participants

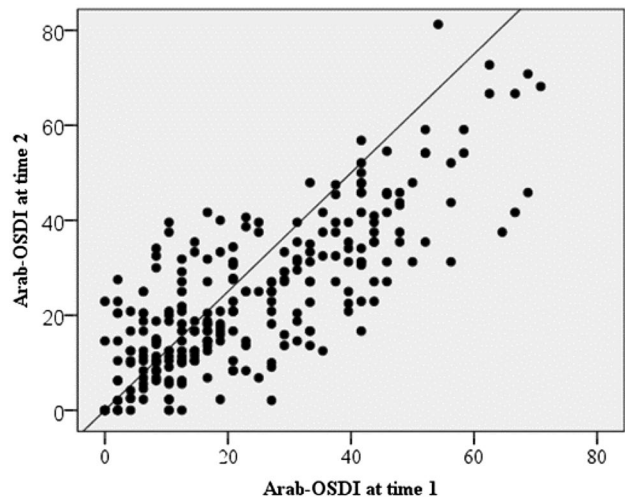
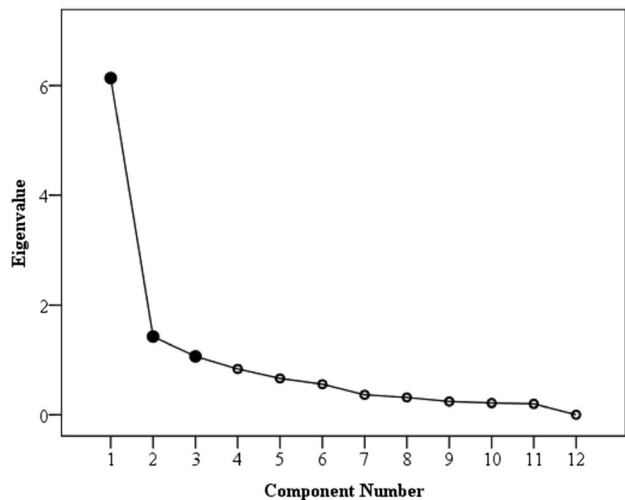


Fig. 7 Scree plot of Arab-OSDI questionnaire in factor analysis. The bold circles represent the three factors (subscales) and all variables ≥ 1.00 were reported



the repeatability test after 72 h. On the contrary, the current study of the test–retest reliability was carried out after one to two weeks. Admittedly, the information about the duration of repeatability relied on the fact that the OSDI was designed to provide assessment of dryness symptoms for the last week [4]. Our limit of agreement (LoA) in the Bland–Altman chart for repeatability ranged from 21.26 to 20.89 (Fig. 5). Both scores were lower than 23 and indicated a moderate dry eye disease in the OSDI overall score [14]. A scatter plot is to show the participant's mean. An improvement was observed during the second Arab-OSDI. Hence, these figures found a good test–retest

repeatability between sessions of Arab-OSDI. The outcomes of Arab-OSDI found that the three subscales (ocular symptoms, vision-related and environmental triggers) accounted for 72.92% of the total variance. Whereas, the classical Arabic study reported that the extracted three subscales explained 68% of the variance [18]. These results revealed that the construct validity of OSDI may be different with the Bakkar et al. study compared to the current study. Finally, our results were slightly higher than the previous study on Arab participants aged 18–75 years old by using the varimax rotation technique.

Table 8 Varimax rotated factor loading of 12 items in Arab-OSDI version ($n = 260$)

Item	Description	Three subscales		
		Factor 1	Factor 2	Factor 3
		Ocular irritation symptoms	Change in functional quality of vision	Environmental factors stimuli
Item 1	Discomfort or sensitivity due to light exposure?	0.909		
Item 2	Feeling of a foreign body or grittiness in the eyes?	0.909		
Item 3	Pain or irritation and congestion in the eyes?	0.753		
Item 4	Blurred vision?	0.574		
Item 5	Deteriorating vision?		0.823	
Item 6	Reading?		0.785	
Item 7	Night driving?		0.770	
Item 8	Using digital devices like computers or automated teller machines (ATM)?		0.676	
Item 9	Watching television (TV)?			0.773
Item 10	Stormy weather?			0.738
Item 11	Dry places (with low humidity)?			0.726
Item 12	Air-conditioned places?			0.544

The highest values were presented for single items in the factors

Conclusions

In conclusion, the cross-cultural adaptation of the OSDI questionnaire had demonstrated desirable reliability, validity, repeatability, and factor analysis of the Arabic version. Consequently, the Arab-OSDI is an efficient tool to assess the ocular symptoms, vision-related function, and environmental triggers of dry eye disease. Our outcomes provided an online application of the Arab-OSDI questionnaire on Gazan community adult participants, particularly in primary eye care clinics. Finally, the questionnaire could remove the language barrier in managing their subjects.

On the other hand, the sensitivity of Arab-OSDI was not tested in this study since our study did not explore dry eye participants before answering those items, as carried out by Koh et al. [29] in examining sensitivity. This is a drawback of the study. One of the drawbacks of the online surveys is the population to which they are distributed cannot be described. But our study was done according to number of population structure in each province as defined by the world population review data in the Gaza Strip at 2022 [30]. Item 5 “poor vision” was an Arab back-translated phrase such as “deteriorating vision” which

was associated with the non-use of eyeglasses. This is another drawback of the current study that leads to confusion.

Acknowledgements The researchers would like to specially thank all the Gazan participants who agreed to fill out the consent, original, and translated Arab-OSDI online.

Author contributions All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by MA. The first draft of the manuscript was written by MA and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Ethical standard This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Palestinian Health Research Council Helsinki committee (PHRC/HC/883/21, dated April 05, 2021).

Appendix

مؤشر أمراض سطح العين

هل واجهت أيًا مما يلي خلال الأسبوع الماضي؟	دائما	غالبًا	أحيانًا	نادرًا	مطلقًا
١. حساسية أو انزعاج من تعرض العين للضوء	(٤)	(٣)	(٢)	(١)	(٠)
٢. شعور بجسم غريب أو شد في العينين	(٤)	(٣)	(٢)	(١)	(٠)
٣. ألم أو تهيج واحتقان في العينين	(٤)	(٣)	(٢)	(١)	(٠)
٤. رؤية ضبابية	(٤)	(٣)	(٢)	(١)	(٠)
٥. رؤية متدهورة	(٤)	(٣)	(٢)	(١)	(٠)

(أ) المجموع الفرعي للإجابات من ١ إلى ٥

هل عانيت من مشاكل في عينيك خلال الأسبوع الماضي وعافتك عن أداء الاتي؟	دائما	غالبًا	أحيانًا	نادرًا	مطلقًا	لا ينطبق
٦. القراءة	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق
٧. القيادة ليلاً	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق
٨. استخدام الحاسوب أو الصراف الآلي	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق
٩. مشاهدة التلفاز	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق

(ب) المجموع الفرعي للإجابات من ٦ إلى ٩

هل شعرت عينك بعدم الارتياح في أي من المواقف التالية خلال الأسبوع الماضي؟	دائما	غالبًا	أحيانًا	نادرًا	مطلقًا	لا ينطبق
١٠. أجواء عاصفة	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق
١١. أماكن جافة (ذات رطوبة منخفضة)	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق
١٢. أماكن مكيفة	(٤)	(٣)	(٢)	(١)	(٠)	لا ينطبق

(ت) المجموع الفرعي للإجابات من ١٠ إلى ١٢

أضيف المجاميع الفرعية (أ) و (ب) و (ت) للحصول على (ث)
 (ث = مجموع الدرجات لجميع الأسئلة التي تمت الإجابة عليها)

إجمالي عدد الأسئلة التي تمت الإجابة عليها
 (لا تقم بتضمين الأسئلة التي لم يتم الإجابة عنها)

مؤشر أمراض سطح العين

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