International Journal of Nursing Studies Advances xxx (xxxx) xxx

Contents lists available at ScienceDirect

International Journal of Nursing Studies Advances

journal homepage: www.sciencedirect.com/journal/international-journal-of-nursing-studies-advances

Psychometric evaluation of the Arabic version of the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8): Specific cultural considerations for the assessment of depression

Amira M. Ali [a], Saeed A. Al-Dossary [b], Feten Fekih-Romdhane [c,d], Rana Ali Alameri [e], Carlos Laranjeira [f,g,h], Haitham Khatatbeh [i], Mohamed Ali Zoromba [j,k], Abdulmajeed A. Alkhamees [l,*], Musheer A. Aljaberi [m], Annamaria Pakai [n], Heba Emad El-Gazar [o]

[a] Department of Psychiatric Nursing and Mental Health, Faculty of Nursing, Alexandria University, Smouha, Alexandria 21527
[b] Department of Psychology, College of Education, University of Ha'il, Ha'il 1818, Saudi Arabia
[c] Tunis Al Manar University, Faculty of Medicine of Tunis, Tunis, Tunisia
[d] The Tunisian Center of Early Intervention in Psychosis, Department of Psychiatry Ibn Omrane, Razi Hospital, Tunis, Tunisia
[e] Fundamentals of Nursing Department, College of Nursing, Imam Abdulrahman Bin Faisal University, Dammam 34212, Saudi Arabia
[f] School of Health Sciences, Polytechnic University of Leiria, Campus 2, Morro do Lena, Alto do Vieiro, Apartado 4137, 2411-901 Leiria, Portugal
[g] Centre for Innovative Care and Health Technology (ciTechCare), Rua de Santo André—66–68, Campus 5, Polytechnic University of Leiria, 2410-541 Leiria, Portugal
[h] Comprehensive Health Research Centre (CHRC), University of Évora, 7000-801 Évora, Portugal
[i] Faculty of Nursing, Yarmouk University, Irbid, Jordan, 21163, Haitham
[j] Department of Nursing, College of Applied Medical Sciences, Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia
[k] Psychiatric and Mental Health Nursing Department, Mansoura University, Mansoura, Egypt
[l] Department of Psychiatry, College of Medicine, Qassim University, Buraidah, Al Qassim 52571, Saudi Arabia
[m] Department of Internal Medicine, Section Nursing Science, Erasmus University Medical Center (Erasmus MC), 3015 GD Rotterdam, The Netherlands
[n] Institute of Nursing Sciences, Basic Health Sciences and Health Visiting, Faculty of Health Sciences, University of Pécs, Pécs 7622, Hungary
[o] Department of Nursing Administration, Faculty of Nursing, Port Said University, Port Said, Egypt

ARTICLE INFO

Keywords:
Culture/Arab/Saudi
Depression/depressive symptoms/ somatic complaints/negative affect/positive affect
Eight-item Center for Epidemiological Studies Depression Scale (CESD-8)
Psychometric properties/factor structure/ measurement invariance/validity/reliability

ABSTRACT

Background: Despite extensive evaluations of the Center for Epidemiological Studies Depression Scale (CESD), its shortest version, the Eight-Item version (CESD-8), is less investigated, with absolute lack of information on its psychometric properties in the Arab world.
Methods: To fill the gap, data collected via an anonymous online survey from Saudi samples of students (N = 979, 422) and employees (N = 314), were analyzed through exploratory factor analysis, confirmatory factor analysis, and multigroup analysis to examine the structure and measurement invariance of the CESD-8. Convergent validity and internal consistency tests involved correlating the CESD-8 with its subscales, item analysis measures, and intra class correlations. Criterion validity tests involved correlating the CESD-8 and its subscales with a single-item measure of happiness.
Results: Exploratory factor analysis produced two factors (negative affect and positive affect) with eigen values >1, which explained 86.4 % of the variance. In confirmatory factor analysis, the crude exploratory factor analysis model had good fit while the fit of the unidimensional CESD-8 and another two-factor structure (depressed affect and somatic complaints) was improved by

* Corresponding author at: Department of Psychiatry, College of Medicine, Qassim University, Buraidah, Al Qassim 52571, Saudi Arabia.
E-mail address: A.alkhamees@qu.edu.sa (A.A. Alkhamees).

https://doi.org/10.1016/j.ijnsa.2025.100310
Received 2 September 2024; Received in revised form 16 December 2024; Accepted 9 February 2025
Available online 10 February 2025

Please cite this article as: Amira M. Ali et al., *International Journal of Nursing Studies Advances*, https://doi.org/10.1016/j.ijnsa.2025.100310

correlating the residuals of the items of positive affect (CESD4 and CESD6). A three-factor model (depressed affect, somatic complaints, and positive affect) expressed the best fit in the absence of error correlations. This model was invariant across groups of students and employees, gender, and age. The scale and its three dimensions demonstrated adequate internal consistency (alpha coefficient range = 0.65–0.89), convergent validity (item total correlation range = 0.43–0.80 and range of correlations with the CESD-8 = -0.68–0.92), and criterion validity (range of correlations with happiness scores = -0.40–0.60).

Conclusions: The CESD-8 is a valid short scale for quick identification of people with depressive psychopathologies. Using the CESD-8 to detect heterogenous depressive symptoms, rather than assessing depression as a whole condition, may influence our understanding of the dynamics and treatments of depression in specific groups/cultures, with emphasis on absence of positive affect in the definition of depression among Arabs. Replications of the three-factor structure in different cultures are needed.

1. Introduction

Depression is a major cause of disability striking >322 million people worldwide, with a prevalence increase of 18.4 % between 2005 and 2015 (Greenberg et al., 2021). The greatest occurrence of depression (33.6 %) is noticed among emerging adults i.e., the age of university students (18–24 years) (Li et al., 2022), and the global prevalence in this group has incredibly increased over the last few years (e.g., going from 7.9 % in 2013 to 36.7 % in 2019 in Brazil), which is associated with poor academic performance and behavioral deviations in both genders (e.g., heavy drinking, smoking, and physical inactivity) (Lopes et al., 2021; Li et al., 2023; Mojtabai et al., 2016; Greenberg et al., 2021). The prevalence of depression among Arab students is largely higher than the global prevalence ranging from 30.9 % to 77.6 % (Mahfouz et al., 2020; Mohammad et al., 2020; AlJaber, 2020). This situation is quite alarming given that youth under the age of 25 years are the largest population segment (60 %) in the Arab world, which comprises 22 countries that extend in the continents of Asia and Africa, with a total population of >420 million people who share the same language and cultural heritage (Sabah et al., 2024).

Fear of stigmatization and lack of mental health literacy are widespread in the Arab culture (Lindheimer et al., 2020), including university students (Musa et al., 2020). Collectivism is the predominant orientation among Arabs, with a greater focus on community norms/values (e.g., wellbeing) rather than own interests. Therefore, Arabs tend to report physical symptoms more than emotional symptoms (i.e., emotional suppression largely operates as negative emotions may signal spiritual fragility, which is not socially accepted) (Lindheimer et al., 2020; Ali et al., 2022e). Such sociocultural background uniquely influences the prognosis, treatment seeking behavior, and response to treatment among depressed Arabs (Ali et al., 2022a; Ali et al., 2021b). This may explain why thousands of Arabs with depressive complaints opt to online screening, with suicidality indicated in up to 78.9 % of them (Dardas et al., 2016; Daouk et al., 2023).

Depression is a highly heterogenous condition, which comprises somatic (e.g., fatigue, sleep problems) and interpersonal/cognitive-affective symptoms (e.g., anhedonia, low mood, hopelessness, and poor concentration) (Blodgett et al., 2021; Herrera Legon, 2021; Iob et al., 2020). These symptoms largely vary in their etiology (e.g., aging, progressive physiological dysfunction, stress and cultural orientation) (Lindheimer et al., 2020; Megreya et al., 2018; Herrera Legon, 2021), which may justify high treatment resistance/failure among patients prescribed antidepressants (Jaffe et al., 2019; Ali et al., 2023). Various depressive symptom (e.g., negative affect and somatic complaints) are also differentially linked with core psychological constructs (e.g., life satisfaction or perceived autonomy and control) (Schlechter et al., 2022). Therefore, symptom-level investigations and multidimensional models of depression are appealing to researchers as they reveal more specific symptom profiles, which may implicate treatment outcomes (Wasil et al., 2021; Iob et al., 2020).

Given the multi-faceted nature of depression, psychological interventions based on positive psychology appear as a convenient alternative to antidepressant therapy, with reported variations in their efficacy across cultures (Cuijpers et al., 2021; Carr et al., 2021). From a biological perspective, positive view of life expressed as the psychological state of subjective wellbeing is regulated by a dynamic biological mechanism that promotes homeostatic balance while loss of subjective wellbeing mirrors clinical depression, which develops secondary to failure of the homeostatic defense system (Cummins, 2010). Clinically, low subjective wellbeing predicted only clinical depression in a sample of men diagnosed with various Diagnostic Statistical Manual-IV-TR Axis 1 disorders (e.g., posttraumatic stress disorder, panic disorder, social phobia and specific phobia) (Gargiulo and Stokes, 2009). Subjective wellbeing encompasses various cognitive and affective mental states, yet its nature remains enshrouded in theoretical complexity and controversy. Nonetheless, emotions rather than cognitions are referred to as an essential aspect of subjective wellbeing, which is frequently signaled by emotional expressions (e.g., laughing, smiling or crying, and verbal expressions of feeling cheerful or joy). In this sense, subjective wellbeing is sometimes referred to as “happiness” (Kusier and Folker, 2021). Candidate components of subjective wellbeing such as purpose in life are largely related to happiness as well as depression, and these associations are considerably stronger than those noticed between purpose in life and anxiety (Crego et al., 2021). Moreover, lay people from 12 countries describe happiness as a combination of inner harmony and social connectedness in addition to numerous wellbeing constructs such as meaning in life, life satisfaction, positive emotions, positive states, optimism, and absence of emotional negativity (Delle Fave et al., 2016). In the meantime, happiness therapies can significantly reduce negative mental states (depression, anxiety, and stress) and risky health behaviors (e.g., binge drinking) as well as promote emotional and social skills (Seppälä et al., 2020; Elsharkawy et al., 2021). They also

positively influence somatic depressive symptoms such as pain (Feneberg et al., 2021). Interestingly, the effects of happiness therapies among university students are superior to the effects of therapies hitting mindfulness and emotional intelligence (Seppälä et al., 2020). Moreover, the greatest positive effects of interventions targeting subjective wellbeing are noticed among patients from non-Western cultures, including Arabs (Basurrah et al., 2023; Carr et al., 2021).

It is important to develop culturally sensitive measures that can subtly and accurately screen for depression in different groups and settings. Nurses operate in multidisciplinary teams to support the diagnosis and treatment of depression. Short measures may benefit nurses in busy clinical settings as they require less time to be administered. Brief interviews also require less patience from the clients, which translates into greater response rates (Bains et al., 2024; Muench et al., 2017; Ali et al., 2021a).

The Eight-item Center for Epidemiological Studies Depression Scale (CESD-8) is a shortened version of the 20-item CESD. Being translated into many languages, the CESD-8 has been widely used in different populations (older adults, general populations, adolescents, families, women, ethnic groups, and psychiatric patients) in many parts of the world (Bi et al., 2023; Radloff, 1977; Wang et al., 2017; Chang and Jhang, 2021). It is verified in the literature by 1) correlating with depression measures not based on self-reporting (Turvey et al., 2005; Courtin et al., 2015), 2) its ability to detect differences associated with objective conditions and health variables (e.g., diagnoses of cancer and lung disease (Kozlov et al., 2020), changes in life circumstances (e.g., loneliness from the period before COVID-19 to the peak of the pandemic (Sun et al., 2024), and declines in physical health over time among older adults (Han, 2002)); 3) correlating with genetics of depression (Chen et al., 2023; Park et al., 2023; Chen et al., 2024) and biological markers of physiological deterioration (e.g., serum cystatin C (Han et al., 2022)); 4) significant increases in scale scores and associations with limitations in activity of daily living and poor quality of life in people who near the end of life (Kozlov et al., 2020; Reed, 2020); 5) child abuse among depressed patients (Chen et al., 2024) and environmental risks for depression (e.g., pollution, noise, artificial light at night, and lack of greenspace) (Fossa et al., 2024); and 6) occurrence at higher levels among females as well as Black and Hispanic ethnic minorities (they express greater vulnerability to depression than males and White ethnicity) (Chen et al., 2023; Wang et al., 2017; Park et al., 2023). Despite extensive examination of the CESD-8, the literature indicates disagreement on its factor structure and measurement invariance both in Western and non-Western cultures (Schlechter et al., 2022; Van de Velde et al., 2010; Wang et al., 2017). Therefore, it is not possible to expect the psychometric behavior of this brief version in Arabic, especially as the Arabic CESD expressed two factors in one study while multiple models exhibited exceptionally poor fit in another study (Kazarian and Taher, 2010; Rababah et al., 2020).

Aiming to validate the Arabic CESD-8, this study fills a gap in the literature. This study hypothesized that the CESD-8 will express a bidimensional structure in Saudi adults (university students/employees) because a two-factor structure of two negative domains (depressed affect and somatic complaints) is more frequently reported for the CESD-8, and it is more robust than the unidimensional structure (Briggs et al., 2018; Schlechter et al., 2022; Van de Velde et al., 2009), especially in non-Western participants (Bi et al., 2023; Chang and Jhang, 2021). Also, it was hypothesized that the CESD-8 factors/subscales and items will strongly correlate with the total scale score. Happiness is an eminent aspect of positive mental health, which is consistently associated with both wellbeing and depression as noted above. Therefore, happiness was chosen to test the criterion validity of the CESD-8, and according to the literature, the CESD-8 as a measure of depression would negatively correlate with happiness.

2. Materials and methods

2.1. Study design

This cross-sectional study recruited three independent convenience samples from the Kingdom of Saudi Arabia to avoid pseudo-validation defects, which result when exploratory and confirmatory factor analyses are performed simultaneously using the same data (Ali et al., 2022e). Because the CESD-8 comprises only eight items, the rule of thumb (10 responses per item) would suggest that a sample of 80 responses is sufficient to examine its factor structure (Boateng et al., 2018; Ali and Green, 2019). Nevertheless, measures of negative emotions, including the CESD-8 commonly display a non-normal distribution (Schlechter et al., 2022), which affects the accuracy of the factor loadings and introduces instability in the factor structure as well as bias in other psychometric tests such as those of internal consistency (Ali et al., 2022d). Meanwhile, bigger samples sizes, not test lengths, help improve the precision of psychometric tests in non-normal data (Sheng and Sheng, 2012). Therefore, we recruited more participants, and the present sample sizes can be judged as good-to-excellent based on conservative standards (300 – 900 responses) (Boateng et al., 2018).

2.2. Participants

The first sample was used for conducting exploratory factor analysis, and it comprised 422 students from Umm Al-Qura University (75.6 % females). The participants were primarily receiving a bachelor ($n = 301$, 71.3 %), academic diploma ($n = 17$, 4.0 %), master ($n = 62$, 14.7 %), and doctorate ($n = 42$, 10.0 %) degrees. Two samples comprising students from the Saudi Electronic University and Qassim University ($N = 979$, 65.9 % females, 66.0 % aged 29 years or below) and employees ($N = 314$, 32.2 % females, 57.6 % aged 35 years or above) were recruited for conducting confirmatory factor analysis and multigroup analysis. Employees were mostly married ($n = 216$, 68.8 %), and the rest were single/widowed/divorced ($n = 98$, 31.2 %). They had an average work experience of 13.37 years (SD = 8.70, range = 1–40 years). Age categories of the student and employee samples are detailed in supplementary file 1.

2.3. Procedure

The participants were recruited through an online survey conducted in Google Forms starting from December 25, 2020 to January 21, 2021. Each sample was recruited separately during this period. For the student samples, the link to the questionnaire was shared through student mailing lists, and no study credits were given for participation. For the employee sample, the link to the questionnaire was shared through the mailing lists of numerous companies, schools, hospitals, and banks in the capital city of Riyadh as well as in the cities of Ha'il, Mecca, and Jeddah. For all the samples, participation was anonymous, without any kind of compensation, and the inclusion criteria were being 18 years or older, being fluent in Arabic (the language in which the questionnaire was administered), and agreeing to complete the online questionnaire. To lower non-response, the sociodemographic characteristics collected were very limited (e.g., age and gender).

2.4. Ethics

All the participants were informed about the aim of the study and reassured that their data will be kept confidential; they signed a digital informed consent before completing the questionnaire. The Research Ethics Committee of Hai'l University approved the study protocol (No. 16784/5/42. November 5, 2020).

2.5. Study instruments

The participants completed a structured online questionnaire, which first inquired about their gender and age categories. It prompted the participants to complete the CESD-8—an eight-item measure, which comprises six negative affect items "e.g., felt depressed, felt lonely, felt sad, could not get going" and two positive affect items "enjoyed life" and "felt happy". Items are rated on a four-point scale ranging from 0 (rarely) to 3 (most of the time). Items of positive affect are inverse coded [8]. The English CESD-8 was translated into Arabic according to standard guidelines indicated by Brislin (Brislin, 1970). Two independent bilingual experts from the English Language Department in Hai'l University translated the scale into Arabic. Because of the simple and short sentences of the CESD-8, there was minimal disagreement on the grammatical–syntactical, idiomatic, and conceptual equivalence of the items of the translated version between them. Particularly, the two translators had a thorough discussion on the conceptual equivalence of one item "I felt everything I did was an effort", which can be expressed in Arabic as "everything made me tired" or "everything was difficult for me to initiate/perform". The scale was then back translated into English by another bilingual expert. The back-translated version was almost identical to the original English version, which suggests minimal alterations in the meaning following scale translation into Arabic. The original English scale and the translated Arabic version were handed to three experts from Hai'l University who obtained a doctorate degree in psychology to evaluate its face and content validity. They noted that all the items are clear, well-understood, and pertain to the measurement of depression.

The participants also rated their level of happiness over the last week on Fordyce's Emotion Questionnaire—a single-item measure of general happiness "Taking all things together, how happy would you say you are?" [44]. This measure is rated on a 10-point scale, which ranges from 0 (completely unhappy) to 10 (completely happy). This measure was translated into Arabic same as the CESD-8, and it was used for criterion validity testing.

2.6. Statistical analysis

The descriptive statistics of the samples were reported using mean and standard deviation for continuous variables as well as frequency and percentage for categorical variables. To examine the structure of the CESD-8, its items were first permitted to load on the corresponding factors through exploratory factor analysis, which was conducted using the student sample from Umm Al-Qura University ($N = 422$). Maximum-likelihood extraction was employed as a method of estimation with varimax rotation, Kaiser-Meyer-Olkin measure of sampling adequacy, and Bartlett's test of sphericity.

Exploratory factor analysis allows items to load freely on their domain-specific factors, resulting in identification of underlying constructs that match participants' responses i.e., the structure of the data is determined through the analysis instead of being predefined. On the contrary, confirmatory factor analysis tests pre-specified theoretical models. As such, it forces the items to load on specific factors and checks for the best fit. Model modifications such as correlating error terms, cross loadings, creating new factor/omitting some factors, as well as deleting items may be done to produce a clean factor structure that comprises only items that significantly contribute to the most relevant latent structure. The decision to delete items depends on the values of item loadings (<3) and item total correlations. The latter are often extremely low for misfitting items (Ali et al., 2022d; Widaman and Helm, 2023). Confirmatory factor analysis (maximum likelihood method) was conducted in the second student sample (from Qassim university and the Saudi Technological University: $N = 979$) and the employee sample ($N = 314$). Four competing models were tested; they included all structures of the CESD-8 that have been previously reported in the literature: 1) Model 1: the unidimensional structure of the CESD-8 (Missinne et al., 2014), 2) Model 2: a two-factor solution that comprised somatic complaints (item 2, item 3, and item 8) and depressed affect (all other items) (Schlechter et al., 2022; Briggs et al., 2018); 3) Model 3: a replication of the structure revealed by our exploratory factor analysis, which comprised positive affect (item 4 "felt happy" and item 6 "enjoyed life") and negative affect, which comprised the rest of the items and; 4) Model 4: a three-factor solution, which comprised positive affect, depressed affect, and somatic complaints/interpersonal problems (Chang and Jhang, 2021; Wang et al., 2017). In multigroup confirmatory factor analysis, four nested models (unconstrained, constrained factor loadings, constrained intercepts, and constrained residuals) were conducted to

examine configural, metric, scalar, and strict invariance (Ali et al., 2022c) across groups of gender in the student and employee samples, age in the employee samples (<40 vs ≥40 years), and status (student vs employee).

For confirmatory factor analysis and multigroup analysis, good/acceptable global model fit is indicated by a non-significant chi square (χ^2) index, which can be sensitive to sample size (Ali et al., 2022d). Therefore, absolute fit indices are also considered: Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI) equal to or above 0.95 and 0.90, respectively, along with root mean square error of approximation (RMSEA) and standardized root-mean-square residual (SRMR) <0.06 and 0.08, respectively (Ali et al., 2024b). When needed, model fit was improved by correlating suggested error residuals highlighted by modification indices. For multigroup analysis with a significant χ^2, misfit was signposted by ΔCFI and ΔRMSEA exceeding 0.02 and 0.015 (Ali et al., 2024a).

The reliability and convergent validity of the CESD-8 and its subscales that emerged from the best fitting model (Model 4) were estimated by coefficient alpha, alpha if item deleted, item-total correlations, and inter item correlations in the three samples. Intraclass correlation coefficient estimates with 95 % confident intervals (*CI*) were calculated in the three samples based on a mean-rating (k = 422, 979, and 314), absolute-agreement, and two-way random-effect models. Single measures for intraclass correlations were estimated using a consistency definition (Koo and Li, 2016). The criterion validity of the CESD-8 and its subscales was estimated by Spearman's correlation with Fordyce's Emotion Questionnaire—the measure of happiness. The analyses were conducted in SPSS version 28 and Amos version 24. A probability of <0.05 indicated significance in two-tailed tests.

3. Results

3.1. Results of exploratory factor analysis

Exploratory factor analysis shows that the CESD-8 among students from Umm Al-Qura University ($N = 422$) covers two factors with eigen values >1, which explained 52.7 % and 15.7 % of the variance. As shown in Table 1, inversely coded items "was happy" and "enjoyed life" loaded on only one factor, which represents a domain of positive affect. In the meantime, the rest of the items loaded on the other factor "depressed affect and somatic symptoms". As indicated by Kaiser-Meyer-Olkin (0.82) and Bartlett's test ($\chi^2(21) = 1262.67$, $p < .001$), the sample size and participant-to-item ratio were appropriate for exploratory factor analysis. The communalities of all the items were high except for item 3 "restless sleep"; however, its loading on factor 1 was above 0.4 indicating acceptable association with the negative affect domain.

3.2. Results of confirmatory factor analysis and invariance analysis

Confirmatory factor analysis comparing different competing structures of the CESD-8 indicated adequate item loadings (≥ 0.5) in all the models as shown in Fig. 1. The unidimensional model and two-factor structure (Model 2) had poor fit, especially in the employee sample (Table 2). However, the fit of both models considerably improved after correlating the residuals of item 4 and item 6 (Fig. 1: a-d). The fit of Model 3 was acceptable and good among employees and students, respectively. Correlating two error terms (Fig. 1: e, f) produced an excellent fit. Model 4, which comprised three factors, expressed the best fit in both samples with no need to correlate any residuals. Accordingly, this model was used in multigroup analysis, and it expressed full invariance across gender in both samples and across the status of student vs employee. It tended to be partially invariant at the scalar level across age among employees; however, *ΔRMSEA* did not reach the known threshold for non-invariance (Table 3).

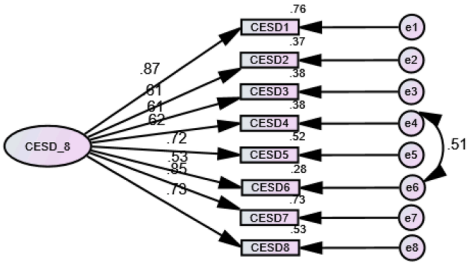
3.3. Internal consistency of the CESD-8 and its subscales

The internal consistency of the CESD-8 and two of its subscales (depressed affect and positive affect) was very good in all the samples. The reliability of the somatic complaint subscale ranged from acceptable to good (Table 4). The values of alpha if item deleted denoted that removing any item would result in a decrease in scale reliability. For the CESD-8, the values of the average measure intraclass correlation coefficient were similar to coefficient alpha (supplementary file 2), indicating good scale reliability. On the other

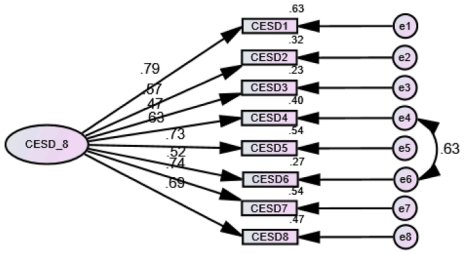
Table 1
Item Loadings on Corresponding Factors as Revealed by Exploratory Factor Analysis of the Eight-item Center for Epidemiological Studies Depression Scale (CESD- 8) among students from Umm Al-Qura University ($N = 422$).

Items		*Mean*	*SD*	Communalities	Extracted factors	
					Factor 1	Factor 2
1	Felt depressed	1.11	0.99	.60	**.80**	.27
2	Everything was an effort	1.42	0.97	.42	**.65**	.18
3	Restless sleep	1.74	1.05	.27	**.51**	.16
4	Felt happy	1.42	0.84	.55	.23	**.97**
5	Felt lonely	1.20	1.08	.44	**.69**	.18
6	Enjoyed life	1.49	0.93	.52	.26	**.66**
7	Felt sad	1.23	0.96	.59	**.79**	.27
8	Could not get going	1.11	0.99	.60	**.80**	.27
Eigen values					3.69	1.10

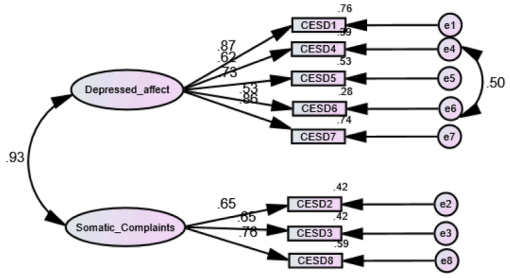
Values in boldface represent significant loadings.



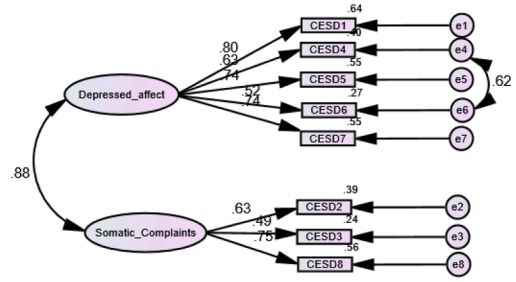
(a) Model 1: unidimensional CESD-8 in the student sample



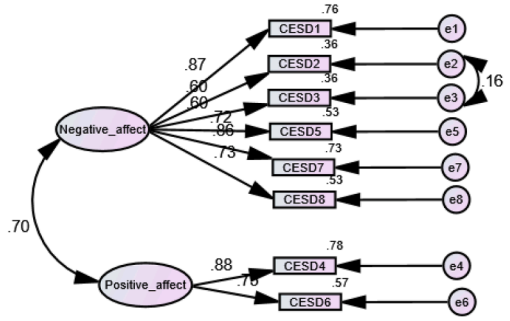
(b) Model 1: unidimensional CESD-8 in the employee sample



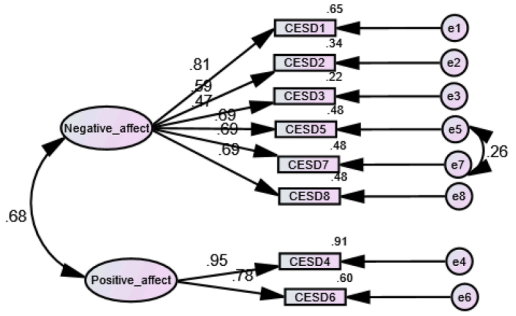
(c) Model 2: two-factor structure CESD-8 (negative affect and somatic complaints) in the student sample



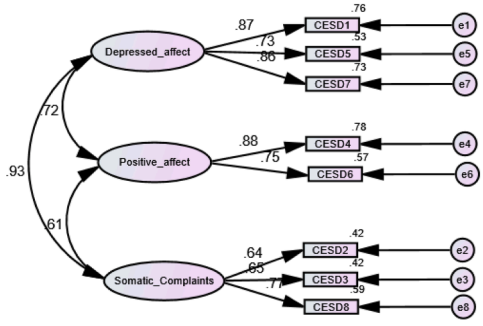
(d) Model 2: two-factor structure CESD-8 (negative affect and somatic complaints) in the employee sample



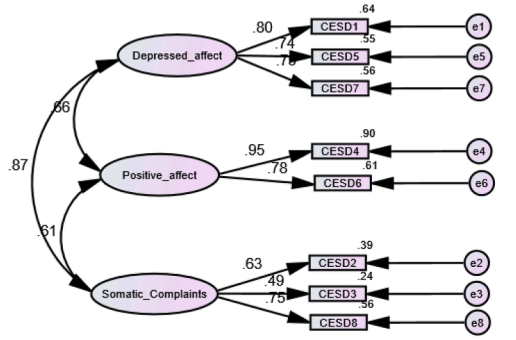
(e) Model 2: EFA-based two-factor structure CESD-8 (negative affect/somatic complaints and positive affect) in the student sample



(f) Model 2: EFA-based two-factor structure CESD-8 (negative affect/somatic complaints and positive affect) in the employee sample



(g) Model 4: three-factor structure CESD-8 (negative affect, somatic complaints, and positive affect) in the student sample



(h) Model 4: three-factor structure CESD-8 (negative affect, somatic complaints, and positive affect) in the employee sample

Fig. 1. Confirmatory factor analysis of four competing structures of the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8) in student (a, c, e, g) and employee (b, d, f, h) Saudi samples, in order: Model 1 unidimensional CESD-8 (a, b), Model 2 "two-factor structure: negative affect and somatic complaints" found in the literature (c, d), Model 3 "two-factor structure: negative affect/somatic complaints and positive affect" found in EFA (e, f), and Model 4 "three-factor structure: negative affect, somatic complaints, and positive affect" found in the literature (g, h).

Table 2
Goodness-of-Fit of The Confirmatory Factor Analysis Models Representing the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8) in The Student and Employee Samples ($N = 979$ and 314, respectively).

Models		Samples	χ^2	*p*	*df*	*CFI*	*TLI*	*RMSEA*	*RMSEA 90 % CI*	*SRMR*
Model 1	Crude	Students ($N = 979$)	341.00	.001	20	.916	.883	.128	.116 to 0.140	.058
1F		Employees	19,948.09	.001	20	.824	.754	.169	.148 to 0.191	.071
	Correlated error	Students ($N = 979$)	70.41	.001	19	.987	.980	.053	.040 to 0.066	.026
		Employees	62.55	.001	19	.957	.937	.086	.063 to 0.110	.038
Model 2	Crude	Students ($N = 979$)	307.81	.001	19	.925	.889	125	.113 to 0.137	.054
2F		Employees	186.71	.001	19	.836	.758	.168	.146 to 0.190	.068
	Correlated error	Students ($N = 979$)	43.07	.001	18	.993	990	.038	.023 to 0.052	.019
		Employees	52.40	.001	18	.966	.948	.078	.054 to 0.103	.035
Model 3	Crude	Students ($N = 979$)	70.41	.001	19	.987	.980	.053	.040 to 0.066	.026
$2F_{EFA}$		Employees	62.55	.001	19	.957	.937	.086	.063 to 0.110	.038
	Correlated error	Students ($N = 979$)	46.82	.001	18	.992	.988	.040	.026 to 0.055	.021
		Employees	48.00	.001	18	.971	.954	.073	.048 to 0.098	.034
Model 4	Crude	Students ($N = 979$)	36.89	.003	17	.995	.991	.035	.019 to 0.050	.017
3F		Employees	51.58	.001	17	.966	.944	.081	.056 to 0.106	.034

χ^2, chi-square; df, degrees of freedom; *CFI*, comparative fit index; *TLI*, Tucker–Lewis index; *RMSEA*, root mean square error of approximation; *CI*, confidence interval; *SRMR*, standardized root mean residual; –, *SRMR* was not produced denoting improper convergence of the model.

hand, the values of the single measure intraclass correlation coefficient were low (Table 4), indicating a possibility of having differences in outcomes between raters (people). Notably, the values of single measures intraclass correlation of the negative affect and positive affect subscales of the CESD-8 were considerably higher than that of the parent scale (95 % *CI* upper bound of 0.69 and 0.79), denoting lower rater error variability for those two subscales.

3.4. Convergent validity, normality, and criterion validity of the CESD-8 and its subscales

Convergent validity of the CESD-8 and its three dimensions was demonstrated by high values of item total correlations and mean inter item correlations of the depressed affect and positive affect subscales. They were remarkably higher than those of the CESD-8 in the three samples. Those of the somatic complaint subscale were comparable to those of the parent scale (Table 4). The predictive form of convergent validity of the CESD-8 was supported by strong correlations between the CESD-8 and its three subscales (Table 5).

Descriptive statistics of the CESD-8 and its subscales are shown in Table 5, suggesting higher depression scores among students from both samples than employees. Shapiro–Wilks' W test shows that the normality of distribution of the three subscales of the CESD-8 is comparable with that of the parent scale, Table 5. Students from Umm Al-Qura University demonstrated an average happiness score of 6.93 ± 2.23. As hypothesized, the CESD-8 and its subscales had strong statistically significant negative correlations with happiness—only the positive affect subscale positively correlated with happiness, which denotes adequate criterion validity.

4. Discussion

Since the CESD-8 has been tested only in Western countries (Briggs et al., 2018; Karim et al., 2015; Van de Velde et al., 2010) and China (Chang and Jhang, 2021; Bi et al., 2023), this study fills a gap by expanding the literature on the psychometric properties of the CESD-8 in an Arab context. The results are interesting as they highlight the eminence of the positive affect symptom component in different structures (unidimensional, bipartite, and tripartite) of the CESD-8, which demonstrated acceptable to excellent fit, with significantly high item loadings in all the models and absolute absence of error correlations only in the three-dimension structure. Tests of internal consistency, intraclass correlation, convergent validity, and criterion validity denote adequate psychometrics of the three-factor structure, which was invariant across different groups in the student and employee samples.

Our findings are consistent with those of many studies, which reported good fit of the unidimensional structure of the CESD-8 (Missinne et al., 2014; Courtin et al., 2015). However, correlated items in that model revealed in our study reflect a violation of local independence of items. Likewise, the residuals of the items of positive affect also previously correlated in a sample of 11,391 English older adults (Schlechter et al., 2022). As hypothesized, a two-factor structure of the CESD-8 emerged in our exploratory factor analysis; it comprised positive affect and negative affect— positive affect appeared as a distinct dimension in four previous tests of the parent scale, the CESD, in Arab cultures (Lebanon, Jordan, and Egypt) (Mahdy and Abou Nazel, 2002; Ghubash et al., 2000; Kazarian and Taher, 2010; Dardas et al., 2019). However, we did not expect to find a positive affect domain before commencing our analyses as the existing literature reports two negative domains of the CESD-8 (depressed affect and somatic complaints) (Briggs et al., 2018; Schlechter et al., 2022; Van de Velde et al., 2009). The two-factor structure elicited from exploratory factor analysis was further improved by correlating two different items in the negative affect factor in two samples (Fig. 1: e, f). Replication of the two-factor structure previously reported in Irish and English older adults (Schlechter et al., 2022; Briggs et al., 2018) demonstrated good fit when two errors were correlated (Fig. 1: c, d). Despite good fit, error correlations in both two-factor structures may indicate a sort of item redundancy in their current location. This problem seems to be remedied in the three-factor model—its fit was excellent without any need to correlate any error terms, signifying that similar conceptual contents have been located to the same factors in that model. It is worth mentioning that RMSEA fit index in Model 1 (with correlated errors) was high in the employee sample. It was also marginally

Table 3
Invariance of the Three-Factor Structures of the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8) across Gender and age in the Employee Sample and across the Two Samples (Students vs Employees: $N = 979$ and 314, respectively).

Samples	Groups	Invariance levels	χ^2	*df*	*p*	$\Delta\chi^2$	Δdf	$p(\Delta\chi^2)$	*CFI*	*ΔCFI*	*TLI*	*ΔTLI*	*RMSEA*	*ΔRMSEA*	*SRMR*
Students	Gender (males vs females)	Configural	62.53	34	.002				.993		.988		.029		.024
		Metric	68.03	39	.003	5.50	5	.358	.992	.001	.989	−0.001	.028	.001	.025
		Scalar	75.32	45	.003	7.29	6	.295	.992	.000	.990	−0.001	.026	.002	.029
		Strict	85.74	53	.003	10.42	8	.273	.991	.001	.991	−0.001	.025	.001	.028
Employees	Gender (males vs females)	Configural	70.49	34	.001				.965		.942		.059		.040
		Metric	76.45	39	.001	5.96	5	.310	.964	.001	.948	−0.006	.055	.004	.042.044
		Scalar	81.79	45	.001	5.34	6	.501	.964	.000	.956	−0.008	.051	.004	.044
		Strict	95.52	53	.001	13.73	8	.089	.959	.005	.957	−0.001	.051	.000	
Students	Age (<30, ≥30 years)	Configural	62.35	34	.002				.992		.988		.029		.023
		Metric	65.67	39	.005	3.32	5	.651	.993	.00-	.990	−0.002	.026	.003	.022
		Scalar	77.59	45	.002	11.92	6	.064	.991	.002	.989	.001	.027	−0.001	.028.025
		Strict	130.12	53	.001	52.53	8	.001	.979	.011	.978	.011	.039	−0.012	
Employees	Age (<40, ≥40 years)	Configural	75.69	34	.001				.962		.937		.063		.045
		Metric	86.06	39	.001	10.37	5	.065	.957	.005	.938	−0.001	.062	.001	.055
		Scalar	120.62	45	.001	34.56	6	.001	.930	.027	.913	.025	.073	−0.011	.112
		Strict	145.94	53	.001	25.31	8	.001	.914	.016	.909	.004	.075	−0.002	.121
Both samples	Employees vs students	Configural	88.53	34	.001				.989		.981		.035		.034
		Metric	95.59	39	.001	7.06	5	.217	.988	.001	.983	−0.002	.034	.001	.041
		Scalar	122.11	45	.001	26.53	6	.001	.984	.004	.980	.003	.036	−0.002	.081
		Strict	175.28	53	.001	53.17	8	.001	.975	.009	.973	.007	.042	−0.006	.072

χ^2, chi-square; *df*, degrees of freedom; *CFI*, comparative fit index; *TLI*, Tucker–Lewis index; *RMSEA*, root mean square error of approximation; *CI*, confidence interval; *SRMR*, standardized root mean residual.

Table 4
Convergent Validity, Internal Consistency, and Intra Class Correlations of the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8) in the Three Sample.

CESD-8 and its subscales	*Range of item total correlations*			*Coefficient alpha*			*Range of alpha if item deleted*			*Intra class correlations (95% CI)*			*F (df)●*			*Inter item correlations Mean (min-max)*		
	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)
Depressed affect	.67-.78	.64-.69	.66-.74	.86	.81	.84	.76-.86	.72-.76	.74-.82	.66 (.63-.69)	.59 (.53-.64)	.63 (.58-.68)	6.81 (978)	5.29 (313)	6.13 (421)	.67 (.61-.75)	.59 (.56-.62)	.64 (.59-.70)
Positive affect	.67	.74	.70	.80	.85	.83	--	--	--	.66 (.63-.70)	.74 (.69-.79)	.70 (.65-.74)	4.96 (978)	6.73 (313)	5.63 (421)	.67 (.67-.67)	.74 (.74 -.74)	.71 (.71-.71)
Somatic complaints	.55-.56	.37-.50	.48-.54	.73	.65	.67	.63-.65	.49-.66	.54-.63	.47 (.43-.51)	.38 (.31-.45)	.42 (.36-.48)	3.69 (978)	2.81 (313)	3.19 (421)	.48 (.47-.48)	.38 (.32-.49)	.42 (.37-.46)
CESD-8	.57-.80	.43-.71	.48-.75	.89	.86	.86	.86-.88	.82-.86	.83-.86	.49 (.46-.52)	.42 (.38-.47)	.44 (.40-.48)	8.66(978)	6.85(313)	7.30(421)	.49 (.31-.75)	.43 (.22-.74)	.44 (.22-.70)

CESD-8: Eight-item Center for Epidemiological Studies Depression Scale, *df*: degree of freedom, ●: *p* for the test in all the samples is significant at.001.

Table 5
Descriptive Statistics, Normality, and Criterion validity of the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8) in the Samples.

CESD-8 and its subscales	*Median (Q1-Q2)*			*Shapiro–Wilks' W (df)●*			*Correlation with the CESD-8*			*Correlation with happiness*
	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)	Students (N = 422)	Employees	Students (N = 979)	Students (N = 979)
Depressed affect	3 (1–6)	2 (0–3)	3 (1–6)	0.93 (979)	0.86(315)	0.94 (422)	.92**	.89**	.87**	−0.51**
Positive affect	3 (2–4)	2 (2–4)	3 (2–4)	0.94 (979)	0.92(315)	0.94 (422)	−0.75**	−0.75**	−0.68**	.60**
Somatic complaints	3 (2–5)	2 (1–4)	4 (2–6)	0.95 (979)	0.91(315)	0.96 (422)	.87**	.86**	.88**	−0.45**
CESD-8	9 (5–14)	7 (4–10)	10 (6–15)	0.97 (979)	0.92(315)	0.98 (422)	–	–	–	−0.40**

CESD-8: Eight-item Center for Epidemiological Studies Depression Scale, df: degree of freedom, ●: p for the test in all the samples is significant at the level of.001, **: correlations are significant at the level of.01.

high (up to 0.081) in well-fitted models such as Model 4. Scientific evidence shows that RMSEA may mistakenly denote misfit of well-fitting models that have few degrees of freedom, such as the current case of the CESD-8. Therefore, other absolute fit indices (CFI, TLI, and SRMR) are more stable, and they should be consulted instead of RMSEA when they are all within the acceptable range (Ali et al., 2022d). All the absolute fit indices demonstrated an excellent fit for Model 4 (Table 2), which had an advantage over the other models due to the absence of error correlations. This finding is consistent with studies reporting bidimensional and three-dimensional structures of the CESD-8 in the United Kingdom (Schlechter et al., 2022), the United States (Wang et al., 2017), and China (Chang and Jhang, 2021).

The occurrence of three evident dimensions of the CESD-8 in Arab, Chinese (Chang and Jhang, 2021), and ethnic samples (Black and Hispanic (Wang et al., 2017)) may be affected by culture-relevant manners of emotional experience and expression (Blodgett et al., 2021). Arabs and Asians tend to display somatic symptoms more than emotional symptoms (Lindheimer et al., 2020; Blodgett et al., 2021; Ali et al., 2021a)—Table 1 shows that the frequency of somatic symptoms (restless sleep) was higher than all other symptoms. In line, Arab refugees seeking outpatient treatment have expressed sleep problems and lack of energy at levels higher than negative affect symptoms on two measures of depression, and stigma has been associated with negative affect symptoms but not with somatic symptoms in that sample (Lindheimer et al., 2020), denoting that the cultural nature of emotional expression. For the same reason, it may be acceptable within a collectivistic context to say that a person is not happy or not enjoying life than saying that he/she is depressed—justifying the presence of lack of positive affect as a unique dimension in our analysis. Another reason is increased habitual use of dysfunctional emotion regulation strategies secondary to reduced preference for positive emotion (Vanderlind et al., 2020). In this respect, Arabs are reported to express low self-efficacy in managing positive affect, which is associated with greater use of defective emotion regulation strategies (suppression, rumination, other-blame, and acceptance/thoughts of resigning what has happened) relative to Americans. The latter display emotion regulation patterns consistent with the type of emotion (positive or negative) (Megreya et al., 2018). In support of this notion, Arabs' tendency to suppress emotions and negative self-referent cognitions may justify the presence of a distinct dimension of depressed affect (Chahar Mahali et al., 2020). Unlike reports on Arabs' tendency not to express emotional negativity, Arab refugees in Germany have considerably expressed negative affect as well as somatic complaints (Lindheimer et al., 2020). The use of anonymous online survey as a method of data collection may have also implicated the symptoms revealed in the refugee sample and in the present study. This is because Arabs express psychological symptoms of depression more readily in self-report questionnaires and online screening services than in researcher/clinician facilitated face-to-face interviews (Dardas et al., 2016; Chahar Mahali et al., 2020).

Measurement invariance at the configural, metric, and scalar levels permit practical interpretations and comparisons of correlates and mean levels of depressive symptoms among different groups (Ali et al., 2022c). The three-dimensional model expressed invariance across gender. It is pivotal for a symptom scale to hold invariance across gender because most studies often compare depression scores across sexes (Karim et al., 2015). It was also invariant across students and employees as well as across age groups in both samples. This finding is in line with reports of invariance of the CESD-8 as a unidimensional measure of depression across age and country in studies comprising participants from >11 European countries (Missinne et al., 2014; Karim et al., 2015). In contrast, the same unidimensional structure was variant across groups of American and Mexican older adults (Herrera Legon, 2021) as well as Americans of different ethnicities (Black and Hispanic versus White) (Wang et al., 2017). Particularly, item fit was variably improved by items of negative affect (depressed, felt sad) and positive affect (enjoyed life, felt happy) while items of somatic symptoms (everything was an effort, restless sleep, could not get going) produced the least improvement in fit (Herrera Legon, 2021). Network analysis shows that sadness and depressed mood are the most central depressive symptoms in Chinese older adults while somatic symptoms such as restless sleep are the least central (Li and Zhang, 2024). Variability in responding patterns between groups, especially regarding somatic symptoms (e.g., sleep disturbances) and positive affect may be related to cultural influences (e.g., emotional regulation and stigma), biological factors (e.g., altered stress response, metabolic alterations, chronic diseases, medication intake), personality traits (neuroticism has a critical role in bridging depression and personality), as well as lifestyle and sociodemographic characteristics (Lindheimer et al., 2020; Megreya et al., 2018; Herrera Legon, 2021; Iob et al., 2020; Li and Zhang, 2024). Despite scale invariance in our study, the need to

credibly detect specific depressive symptoms across different groups necessitates investigating the feasibility of the three-dimensional structure of the CESD-8 in different groups and cultures.

The convergent validity of the CESD-8 and its three domains manifested by high item total correlations as well as significant strong correlations of the three domains with the whole scale—the correlation involving the positive emotion domain was negative. This is because the large number of items pertaining to negative symptoms on the CESD-8 makes it globally a measure of negative emotions (depression). This result indicates that the CESD-8 subscales are likely to function similarly to the full parent scale when assessing depressive psychopathology. Evidence for criterion validity was revealed by negative correlations of the happiness measure with the CESD-8 and its negative emotion and somatic complaint subscales as hypothesized. Unsurprisingly, the opposite was true for the positive emotion domain of the CESD-8. Same as in former studies (Van de Velde et al., 2010; Missinne et al., 2014; Schlechter et al., 2022), our CESD-8 expressed high internal consistency in the three samples (Table 4). The reliability of its subscales ranged from acceptable (0.65) to excellent (0.86), denoting that the resulting set of items on each subscale are highly consistent/dependable despite their limited number (Alvarenga et al., 2024)—we could not locate information on the reliability of previously reported subscales of the CESD-8. Overall, the results support the validity and reliability of the CESD-8, which is vastly used to identify depression and related physical morbidities in large population-based surveys (Ní Mhaoláin et al., 2012; Van de Velde et al., 2009; Chang and Jhang, 2021; Karim et al., 2015).

To our knowledge, this study is the first to examine the psychometrics of the Arabic version of the CESD-8. It used an array of robust validation measures and employed three samples including employees from different age groups and students while most studies examining the CESD-8 recruited older adults aged 50 years and above (Missinne et al., 2014; Karim et al., 2015; Courtin et al., 2015; Chang and Jhang, 2021). Accordingly, nurses and other healthcare professionals in different settings (communities such as schools and universities, nursing homes, primary care, and clinical settings) may use the scale to capture the likelihood of depression in large groups in few minutes. This could provide a cost-effective preliminary diagnostic approach in resource-limited environments, such as Arab societies. The Arabic CESD-8 covers three distinct categories of symptoms: depressed affect, lack of positive affect, and somatic complaints. While simple unweighted sum scores treat all indicators of the underlying latent construct equally, really occurring variations in factor loadings offer different information on the underlying construct. Therefore, relying only on sum scores of the CESD-8 to make an approximation of the change in depression over time can be biased (Schlechter et al., 2022). Taking this into account, the results of the current study have implications for research and practice, especially when planning and monitoring depression treatment and its outcome. Lack of positive affect in the Arabic CESD has been previously reported to be less related to avoidant and anxious attachment than depressed affect (Kazarian and Taher, 2010). In the meantime, specific treatments of depression (e.g., the best-possible-self intervention) have been employed to effectively increase positive affect and optimism. However, momentary positive effects are reported for optimism when conceptualized as positive future expectations not as a general orientation in life (Heekerens and Eid, 2021). Thus, depression is not unidimensional, and better treatment outcomes may occur from approaches that target the most prominent depressive symptoms and their related biological or cognitive-affective correlates (Wasil et al., 2021; Iob et al., 2020). For instance, listening to music perceived as happy can considerably reduce the intensity of chronic pain and associated impairment among depressed patients (Feneberg et al., 2021). Indeed, exploring and treating organic problems in patients primarily reporting somatic symptoms of depression may be more beneficial than cognitive-affective interventions (Kozlov et al., 2020; Iob et al., 2020). The latter may work better in people primarily exhibiting depressed affect and disordered emotional regulation (Megreya et al., 2018) as well as in those whose symptoms change overtime according to surrounding events (Sun et al., 2024). Meanwhile, mood/expectation induction procedures such as the best-possible-self intervention may produce better effects in those with lack of positive affect (Heekerens and Eid, 2021). Future studies addressing these probabilities may benefit from using subscale scores of the CESD-8, rather than the total CESD-8 score, as predictor variables (Pratiwi et al., 2023).

The findings may not be generalized because of some limitations. Data are amenable to social desirability and selection biases owing to the use of an online survey and self-administered questionnaire method of data collection. For the same reason, we were not able to ensure that the questionnaire always reached the target population. Females constituted a majority in most of the samples, which might bias the results since women's tendency to experience major depressive disorder is greater than men (Ali et al., 2022b; Fossa et al., 2024). It was not possible to perform test-retest reliability analysis because of the cross-sectional design—data were collected during the peak of the COVID-19 pandemic where lockdowns were adopted in most countries, and participants' responses may change as a matter of the critical nature of that period, which would yield inaccurate results. Now the pandemic is almost over, we would recommend that future studies conduct a new test–retest evaluation in a representative sample. The samples comprised community-dwelling individuals, with a possibility that some of them may have a psychiatric disorder, which was not reported according to known diagnostic measures—entailing a risk of selection bias. The absence of a clinician-based evaluation of depression in this study, the gold standard, is derived by lack of logistics. While the study assumes an inverse correlation between depression and happiness, both conditions may be expressed at low levels by some individuals due to the confounding effects of factors like prolonged biological stress or anxiety. Meanwhile, happiness is a single emotional state, which may not be the best choice for testing criterion validity as it does not correspond to the complexity of the heterogenous depressive symptom profiles that underly the CESD-8, particularly in the Arab culture where somatic symptoms are more prominent than emotional expression. In this respect, among various depressive symptoms, feeling sad and feeling like a failure display the strongest negative associations with happiness (Wasil et al., 2021). Including more constructs in future studies for criterion validity tests will be useful.

Aiming to recruit a large number of participants, the researchers tried to make the questionnaire as short as possible excluding other measures of depressive symptoms. Thus, lack of the gold standard measures for testing concurrent validity represents another pitfall in the present study. Face and content validity of the measures were implicitly indicated by the experts, and as a result no objective indices were calculated i.e., no technical sense of validity. Therefore, future studies are needed to systematically address the

face and content of the Arabic CESD-8. The Kingdom of Saudi Arabia is the largest country in the Arabian Peninsula comprising 13 regions, which considerably vary according to their level of urbanization, size of the population, type of housing and house ownership (e.g., own villa or rented apartment), house infrastructure, etc. (Abdul Salam et al., 2014). Such regional variations may interfere with factors that affect the experience and expression of depressive symptoms such as lack of support, loneliness, financial stress, etc. We are not able to affirm that most respondents in the employee sample came from a specific city. Having our student respondents mainly from urbanized cities entails that the results obtained from the selected samples should be interpreted with caution as they do not reflect the entire Saudi population. Moreover, the respondents were recruited from a single Arab country while the Arab world comprises 22 countries, which vary in their accents and local customs (Ali et al., 2020; Sabah et al., 2024). Therefore, it is possible that the CESD-8 may display invariance at the country level; investigating the psychometrics of the CESD-8 in other Arab countries may be warranted.

5. Conclusion

Among Saudi students and employees, the unidimensional and two different bidimensional structures of the CESD-8 expressed acceptable-to-good fit after correlating the error terms of two items that reflect positive affect. A three-factor structure comprising negative affect, positive affect, and somatic complaints expressed the best fit in the absence of any error correlations. The three-dimensional measure expressed measurement invariance, along with adequate convergent validity, criterion validity, and reliability. The results emphasize positive affect as a distinct component in the identification of depression-prone individuals, which may implicate the assessment and management of depression. Future investigations of the CESD-8 in diverse groups (e.g., with chronic physical and mental disorders) as well as in other Arab countries are necessary for optimizing the usefulness of the CESD-8 as a brief global measure of depressive pathogenicity.

Funding

None.

Institutional review board statement

The study protocol has been approved by the Research Ethics Committee of Ha'il University (No. 16784/5/42. November 5, 2020).

Informed consent statement

All participants signed a digital informed consent before participation.

Data availability statement

The dataset used to produce the current article will be available from the corresponding author up on reasonable requests.

CRediT authorship contribution statement

Amira M. Ali: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Saeed A. Al-Dossary:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Feten Fekih-Romdhane:** Writing – review & editing, Data curation, Conceptualization. **Rana Ali Alameri:** Conceptualization, Data curation, Methodology, Writing – review & editing. **Carlos Laranjeira:** Writing – review & editing, Software, Conceptualization. **Haitham Khatatbeh:** Writing – review & editing, Project administration, Conceptualization. **Mohamed Ali Zoromba:** Writing – review & editing, Resources, Data curation. **Abdulmajeed A. Alkhamees:** Writing – review & editing, Software, Resources, Project administration. **Musheer A. Aljaberi:** Writing – review & editing, Software, Investigation. **Annamaria Pakai:** Writing – review & editing, Visualization, Conceptualization. **Heba Emad El-Gazar:** Writing – review & editing, Visualization, Investigation.

Declaration of competing interest

The authors declare no conflict of interest.

Acknowledgements

The Researchers would like to thank the Deanship of Graduate Studies and Scientific Research at Qassim University for financial support (QU-APC- 2025).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijnsa.2025.100310.

References

Abdul Salam, A., Elsegaey, I., Khraif, R., AL-Mutairi, A, 2014. Population distribution and household conditions in Saudi Arabia: reflections from the 2010 Census. Springerplus. 3, 530.

Ali, A.M., Ahmed, A.H., Smail, L., 2020. Psychological climacteric symptoms and attitudes toward menopause among Emirati women. Int. J. Environ. Res. Public Health 17, 5028.

Ali, A.M., Al-Amer, R., Atout, M., Ali, T.S., Mansour, A.M.H., Khatatbeh, H., Alkhamees, A.A., Hendawy, A.O., 2022a. The Nine-Item Internet Gaming Disorder Scale (IGDS9-SF): Its Psychometric Properties among Sri Lankan Students and Measurement Invariance Across Sri Lanka, Turkey, Australia, and the USA, 10. Healthcare, p. 490.

Ali, A.M., Al-Amer, R., Kunugi, H., Stănculescu, E., Taha, S.M., Saleh, M.Y., Alkhamees, A.A., Hendawy, A.O, 2022b. The Arabic version of the Impact of Event Scale – Revised: psychometric evaluation in psychiatric patients and the general public within the context of COVID-19 outbreak and quarantine as collective traumatic events. J. Pers. Med. 12, 681.

Ali, A.M., Al-Dossary, S.A., Laranjeira, C., Amer, F., Hallit, S., Alkhamees, A.A., Aljubilah, A.F., Aljaberi, M.A., Alzeiby, E.A., Fadlalmola, H.A., Pakai, A., Khatatbeh, H., 2024a. Effects of Hormonal Replacement Therapy and Mindfulness-Based Stress Reduction on Climacteric Symptoms Following Risk-Reducing Salpingo-Oophorectomy, 12. Healthcare, p. 1612.

Ali, A.M., Al-Dossary, S.A., Laranjeira, C., Atout, M., Khatatbeh, H., Selim, A., Alkhamees, A.A., Aljaberi, M.A., Pakai, A., Al-Dwaikat, T, 2024b. Cardiometabolic morbidity (Obesity and Hypertension) in PTSD: a preliminary investigation of the validity of two structures of the impact of event scale-revised. J. Clin. Med. 13.

Ali, A.M., Alameri, R.A., Brooks, T., Ali, T.S., Ibrahim, N., Khatatbeh, H., Pakai, A., Alkhamees, A.A., Al-Dossary, S.A, 2023. Cut-off scores of the Depression Anxiety Stress Scale-8: implications for improving the management of chronic pain. J. Clin. Nurs. n/a.

Ali, A.M., Alameri, R.A., Hendawy, A.O., Al-Amer, R., Shahrour, G., Ali, E.M., Alkhamees, A.A., Ibrahim, N., Hassan, B.H., 2022c. Psychometric evaluation of the depression anxiety stress scale 8-items (DASS-8)/DASS-12/DASS-21 among family caregivers of patients with dementia. Front. Public Health 10, 1012311.

Ali, A.M., Alkhamees, A.A., Hori, H., Kim, Y., Kunugi, H., 2021a. The Depression Anxiety Stress Scale 21: development and validation of the Depression anxiety stress Scale 8-item in psychiatric patients and the general public for easier mental health measurement in a post-COVID-19 world. Int. J. Environ. Res. Public Health 18, 10142.

Ali, A.M., Green, J., 2019. Factor structure of the depression anxiety stress scale-21 (DASS-21): unidimensionality of the arabic version among Egyptian drug users. Subst. Abuse Treat. Prev. Policy. 14, 40.

Ali, A.M., Hendawy, A.O., Al-Amer, R., Shahrour, G., Ali, E.M., Alkhamees, A.A., Ibrahim, N., Lamadah, S.M.T., Ahmed, A.H., 2022d. Psychometric evaluation of the depression anxiety stress scale 8 among women with chronic non-cancer pelvic pain. Sci. Rep. 12, 20693.

Ali, A.M., Hori, H., Kim, Y., Kunugi, H., 2021b. Predictors of nutritional status, depression, internet addiction, Facebook addiction, and tobacco smoking among women with eating disorders in Spain. Front. Psychiatry 12, 2001.

Ali, A.M., Hori, H., Kim, Y., Kunugi, H., 2022e. The Depression Anxiety Stress Scale 8-items expresses robust psychometric properties as an ideal shorter version of the Depression Anxiety Stress Scale 21 among healthy respondents from three continents. Front. Psychol. 13, 799769.

Aljaber, M.I., 2020. The prevalence and associated factors of depression among medical students of Saudi Arabia: a systematic review. J. Family. Med. Prim. Care 9, 2608–2614.

Alvarenga, M.A.S., Ali, A.M., Guilhermino, C.S., De AZEVEDO, T.G., OlÍMPIO, K.F., Kersul, C., Da Cunha, G.L., Alvares-Teodoro, J., Ribeiro, P.C.C., Mansur-Alves, M., Teodoro, M.L.M., Bandeira, P.F.R, 2024. A cross-sectional network analysis study applied to the depression anxiety stress scale-21 (DASS-21): a new factor revealed. Ment. Illn., 9534110, 2024.

Bains, N., Abdijadid, S., Jl, M., 2024. Major depressive disorder (Nursing) [Updated 2023 Apr 10]. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. Jan-. Available from: *https://www.ncbi.nlm.nih.gov/books/NBK570554/*.

Basurrah, A.A., Di BLASI, Z., Lambert, L., Murphy, M., Warren, M.A., Setti, A., Al-Haj Baddar, M., Shrestha, T, 2023. The effects of positive psychology interventions in Arab countries: a systematic review. Appl. Psychol. Health Well-Being 15, 803–821.

Bi, K., Chen, P., Chen, S., 2023. Validating the 8-item Center for Epidemiological Studies Depression Scale-Chinese (CESD-Chinese). Data from the China Family Panel Studies (CFPS).

Blodgett, J.M., Lachance, C.C., Stubbs, B., Co, M., Wu, Y.-T., Prina, M., Tsang, V.W.L., Cosco, T.D., 2021. A systematic review of the latent structure of the center for epidemiologic studies depression scale (CES-D) amongst adolescents. BMC. Psychiatry 21, 197.

Boateng, G.O., Neilands, T.B., Frongillo, E.A., Melgar-QuiÑonez, H.R., Young, S.L, 2018. Best Practices for Developing and Validating Scales For Health, Social, and Behavioral Research: A Primer, 6. Front Public Health, p. 149.

Briggs, R., Carey, D., O'HALLORAN, A.M., Kenny, R.A., Kennelly, S.P., 2018. Validation of the 8-item Centre for Epidemiological Studies Depression Scale in a cohort of community-dwelling older people: data from The Irish Longitudinal Study on Ageing (TILDA). Eur. Geriatr. Med. 9, 121–126.

Brislin, R.W., 1970. Back-translation for cross-cultural research. J. Cross. Cult. Psychol. 1, 185–216.

Carr, A., Cullen, K., Keeney, C., Canning, C., Mooney, O., Chinseallaigh, E., O'DOWD, A, 2021. Effectiveness of positive psychology interventions: a systematic review and meta-analysis. J. Posit. Psychol. 16, 749–769.

Chahar MAHALI, S., Beshai, S., Feeney, J.R., Mishra, S., 2020. Associations of negative cognitions, emotional regulation, and depression symptoms across four continents: international support for the cognitive model of depression. BMC. Psychiatry 20, 18.

Chang, T.-H., Jhang, F.H., 2021. The latent structure of the Center for Epidemiological Studies depression scale (CES-D) among older adults in China. In: Advances in Social Science, Education and Humanities Research: Proceeding of the 7th International Conference on Social Science and Higher Education (ICSSHE 2021). Atlantis Press, pp. 6–9.

Chen, P., Li, Y., Wu, F., 2023. Gender differences in the association of polygenic risk and divergent depression trajectories from mid to late life: a national longitudinal study. Biodemography. Soc. Biol. 68, 32–53.

Chen, P., Li, Y., Zadrozny, S., Seifer, R., Belger, A., 2024. Polygenic risk, childhood abuse and gene x environment interactions with depression development from middle to late adulthood: a U.S. national life-course study. Prev. Med. 185, 108048.

Courtin, E., Knapp, M., Grundy, E., Avendano-Pabon, M., 2015. Are different measures of depressive symptoms in old age comparable? An analysis of the CES-D and Euro-D scales in 13 countries. Int. J. Methods Psychiatr. Res. 24, 287–304.

Crego, A., Yela, J.R., GÓMEZ-MARTÍNEZ, M.Á., Riesco-Matías, P., Petisco-Rodríguez, C, 2021. Relationships between mindfulness, purpose in life, happiness, anxiety, and depression: testing a mediation model in a sample of women. Int. J. Environ. Res. Public Health 18, 925.

Cuijpers, P., Pineda, B.S., Quero, S., Karyotaki, E., Struijs, S.Y., Figueroa, C.A., Llamas, J.A., Furukawa, T.A., MuÑOZ, R.F, 2021. Psychological interventions to prevent the onset of depressive disorders: a meta-analysis of randomized controlled trials. Clin. Psychol. Rev. 83, 101955.

Cummins, R.A., 2010. Subjective wellbeing, homeostatically protected mood and depression: a synthesis. J. Happiness. Stud. 11, 1–17.

Daouk, S., Dailami, M., Barakat, S., Awaad, R., MuÑOZ, R.F., Leykin, Y, 2023. Suicidality in the Arab world: results from an online screener. Community Ment. Health J. 59, 1401–1408.

Dardas, L.A., Bailey JR, D.E., Simmons, L.A, 2016. Adolescent depression in the Arab region: a systematic literature review. Issues Ment. Health Nurs. 37, 569–585.

Dardas, L.A., Xu, H., Shawashreh, A., Franklin, M.S., Wainwright, K., Pan, W., 2019. Psychometric properties and factor structure of the Center for epidemiologic studies depression scale in a national sample of Arab adolescents. Issues Ment Health Nurs, 40, 437–443.
Delle FAVE, A., Brdar, I., Wissing, M.P., Araujo, U., Castro SOLANO, A., Freire, T., HernÁNDEZ-POZO MDEL, R., Jose, P., Martos, T., Nafstad, H.E., Nakamura, J., Singh, K., Soosai-Nathan, L, 2016. Lay definitions of happiness across nations: the primacy of inner harmony and relational connectedness. Front. Psychol. 7, 30.
Elsharkawy, N.B., Mohamed, S.M., Awad, M.H., Ouda, M.M.A, 2021. Effect of happiness counseling on depression, Anxiety, and stress in women with recurrent miscarriage. Int. J. Womens Health 13, 287–295.
Feneberg, A.C., Mewes, R., Doerr, J.M., Nater, U.M., 2021. The effects of music listening on somatic symptoms and stress markers in the everyday life of women with somatic complaints and depression. Sci. Rep. 11, 24062.
Fossa, A.J., D'SOUZA, J., Bergmans, R.S., Zivin, K., Adar, S.D, 2024. Different types of greenspace within urban parks and depressive symptoms among older U.S. adults living in urban areas. Environ. Int. 192, 109016.
Gargiulo, R.A., Stokes, M.A., 2009. Subjective well-being as an indicator for clinical depression. Soc. Indic. Res. 92, 517–527.
Ghubash, R., Daradkeh, T.K., Al NASERI, K.S., Al BLOUSHI, N.B., Al DAHERI, A.M., 2000. The performance of the Center for Epidemiologic Study Depression Scale (CES-D) in an Arab female community. Int. J. Soc. Psychiatry 46, 241–249.
Greenberg, P.E., Fournier, A.-A., Sisitsky, T., Simes, M., Berman, R., Koenigsberg, S.H., Kessler, R.C., 2021. The economic burden of adults with major depressive disorder in the United States (2010 and 2018). Pharmacoeconomics. 39, 653–665.
Han, B., 2002. Depressive symptoms and self-rated health in community-dwelling older adults: a longitudinal study. J. Am. Geriatr. Soc. 50, 1549–1556.
Han, T., Zhang, L., Jiang, W., Wang, L., 2022. Persistent depressive symptoms and the changes in serum cystatin C levels in the elderly: a longitudinal cohort study. Front. Psychiatry 13.
Heekerens, J.B., Eid, M., 2021. Inducing positive affect and positive future expectations using the best-possible-self intervention: a systematic review and meta-analysis. J. Posit. Psychol. 16, 322–347.
Herrera LEGON, M., 2021. Measurement Invariance in the CESD-8 and Assessment of Mood Correlates Between American and Mexican Community Studies on the Multisystemic Geriatric Depression Cycle. Doctor of Philosophy, University of Central Florida.
Iob, E., Kirschbaum, C., Steptoe, A., 2020. Persistent depressive symptoms, HPA-axis hyperactivity, and inflammation: the role of cognitive-affective and somatic symptoms. Mol. Psychiatry 25, 1130–1140.
Jaffe, D.H., Rive, B., Denee, T.R., 2019. The humanistic and economic burden of treatment-resistant depression in Europe: a cross-sectional study. BMC. Psychiatry 19, 247.
Karim, J., Weisz, R., Bibi, Z., Ur REHMAN, S., 2015. Validation of the eight-item center for epidemiologic studies depression scale (CES-D) among older adults. Current Psychol. 34, 681–692.
Kazarian, S.S., Taher, D., 2010. Validation of the Arabic center for epidemiological studies depression (CES-D) scale in a Lebanese community sample. Eur. J. Psychol. Assess. 26, 68–73.
Koo, T.K., Li, M.Y., 2016. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J. Chiropr. Med. 15, 155–163.
Kozlov, E., Dong, X., Kelley, A.S., Ankuda, C.K., 2020. The epidemiology of depressive symptoms in the last year of life. J. Am. Geriatr. Soc. 68, 321–328.
Kusier, A.O., Folker, A.P., 2021. The satisfaction with life scale: philosophical foundation and practical limitations. Health Care Anal. 29, 21–38.
Li, J., Zhang, J., 2024. Personality traits and depressive symptoms among Chinese older people: a network approach. J. Affect. Disord. 351, 74–81.
Li, T., Shi, L., Xia, Y., Shi, Z., Wang, D., 2023. Recent trend in the prevalence and correlates of depression among Chinese young adults from 2010 to 2018. Youth. Soc. 56, 946–966.
Li, W., Zhao, Z., Chen, D., Peng, Y., Lu, Z., 2022. Prevalence and associated factors of depression and anxiety symptoms among college students: a systematic review and meta-analysis. J. Child Psychol. Psychiatr. 63, 1222–1230.
Lindheimer, N., Karnouk, C., Hahn, E., Churbaji, D., Schilz, L., Rayes, D., Bajbouj, M., BÖGE, K, 2020. Exploring the representation of depressive symptoms and the influence of stigma in Arabic-speaking refugee outpatients. Front. Psychiatry 11.
Lopes, C.D.S., Gomes, N.L., Junger, W.L., Menezes, P.R., 2021. Trend in the Prevalence of Depression and Correlates in Brazil: Results from the National Health Surveys 2013 and 2019. SciELO Preprints.
Mahdy, N.H., Abou NAZEL, M.W., 2002. Reliability,validity and psychometric properties of the arabic version of the Center for Epidemiological Studies- depression (CES-D) scale. J. High Institute Public Health 32, 891–920.
Mahfouz, M.S., Ali, S.A., Bahari, A.Y., Ajeebi, R.E., Sabei, H.J., Somaily, S.Y., Madkhali, Y.A., Hrooby, R.H., Shook, R.A.N., 2020. Association between sleep quality and physical activity in Saudi Arabian University students. Nat. Sci. Sleep. 12, 775–782.
Megreya, A.M., Latzman, R.D., Al-Emadi, A.A., Al-Attiyah, A.A, 2018. An integrative model of emotion regulation and associations with positive and negative affectivity across four Arabic speaking countries and the USA. Motiv. Emot. 42, 566–575.
Missinne, S., Vandeviver, C., Van DE VELDE, S., Bracke, P., 2014. Measurement equivalence of the CES-D 8 depression-scale among the ageing population in eleven European countries. Soc. Sci. Res. 46, 38–47.
Mohammad, S., Almakran, I.W., Al-Montashri, A.S., Mursi, A.M., Alharbi, S.M., Pasha, T.S., Khalid, I., 2020. Depression, anxiety and stress and their associated social determinants in the Saudi college students. Health Psychol. Res. 8, 9263.
Mojtabai, R., Olfson, M., Han, B., 2016. National trends in the prevalence and treatment of depression in adolescents and young adults. Pediatrics. 138.
Muench, U., Perloff, J., Thomas, C.P., Buerhaus, P.I., 2017. Prescribing practices by Nurse practitioners and primary care physicians: a descriptive analysis of Medicare beneficiaries. J. Nurs. Regul. 8, 21–30.
Musa, A., Ashraf, J., Tsai, F.-J., Abolmagd, S., Liu, C., Hussain, H., Voslarova, E., Khalil, M.A., Wolitzky-Taylor, K.B., Lee, D., Sugar, J., Pendi, K., Lee, J., Abdelmaksoud, R., Adel, N., Baron, D., 2020. Depression severity and Depression stigma among students: a survey of universities in five countries. J. Nerv. Ment. Dis. 208, 884–889.
NÍ MHAOLÁIN, A.M., Fan, C.W., Romero-Ortuno, R., Cogan, L., Cunningham, C., Lawlor, B., Kenny, R.-A, 2012. Depression: a modifiable factor in fearful older fallers transitioning to frailty? Int. J. Geriatr. Psychiatry 27, 727–733.
Park, S., Zamil, K., Patrick, R., Forester, B.P., 2023. Polygenic risk scores predict late-life depressive symptoms in older whites, but not in older African Americans: stratified analyses by sex at birth. Am. J. Geriatr. Psychiatry 31, S49–S50.
Pratiwi, B.C., Dusseldorp, E., Karch, J.D., De ROOIJ, M., 2023. Predictive performance of psychological tests: is it better to use items than subscales? Comput. Stat. Data Anal. 185, 107767.
Rababah, J., Al-Hammouri, M.M., Drew, B.L., Ta'AN, W.A., Alawawdeh, A., Dawood, Z., Jawhar, W.E., 2020. Validation of the arabic version of the center for epidemiologic studies depression-revised: a comparison of the CESD-R and CESDR-12. J. Affect. Disord. 274, 450–456.
Radloff, L.S., 1977. The CES-D scale : a self-report depression scale for research in the general population. Appl. Psychol. Measurem. 1, 385–401.
Reed, J., 2020. Depressive symptoms in the last year of life: early screening and varied treatment pathways needed. Evid. Based Nurs. ebnurs-2019-103246.
Sabah, A., Aljaberi, M.A., Hajji, J., El-Mir, M., Al-Najjar, R., Ali, A.M., Hsieh, M.-T., Lin, C.-Y., 2024. Psychometric properties of the Benign and Malicious Envy scale: a cross-cultural study in the Arab Maghreb countries. Acta Psychol. 248, 104397.
Schlechter, P., Ford, T.J., Neufeld, S.A.S., 2022. The eight-item center for epidemiological studies depression scale in the English longitudinal study of aging: longitudinal and gender invariance, sum score models, and external associations. Assessment., 10731911221138930
SeppÄLÄ, E.M., Bradley, C., Moeller, J., Harouni, L., Nandamudi, D., Brackett, M.A, 2020. Promoting mental health and psychological thriving in university students: a randomized controlled trial of three well-being interventions. Front. Psychiatry 11.
Sheng, Y., Sheng, Z., 2012. Is coefficient alpha robust to non-normal data? Front. Psychol. 3.
Sun, H.-L., Zhang, Q., Leong, S.T., Bai, W., Chen, P., Lam, M.I., Lok, K.-I., Su, Z., Cheung, T., Ungvari, G.S., Jackson, T., Sha, S., Xiang, Y.-T., 2024. Interactive changes in depression and loneliness symptoms prior to and during the COVID-19 pandemic: a longitudinal network analysis. Psychiatry Res., 115744
Turvey, C.L., Wallace, R.B., Herzog, R., 2005. A revised CES-D measure of depressive symptoms and a DSM-based measure of major depressive episodes in the elderly. Int. Psychogeriatr. 11, 139–148.

Van DE VELDE, S., Bracke, P., Levecque, K., Meuleman, B., 2010. Gender differences in depression in 25 European countries after eliminating measurement bias in the CES-D 8. Soc. Sci. Res. 39, 396–404.

Van DE VELDE, S., Levecque, K., Bracke, P., 2009. Measurement Equivalence of the CES-D 8 in the General Population in Belgium: a Gender Perspective, 67. Archives of Public Health, pp. 1–15.

Vanderlind, W.M., Millgram, Y., Baskin-Sommers, A.R., Clark, M.S., Joormann, J., 2020. Understanding positive emotion deficits in depression: from emotion preferences to emotion regulation. Clin. Psychol. Rev. 76, 101826.

Wang, Y., Shen, H., Hurwicz, M., 2017. Measuring depressive symptoms with 8-item and 9-item Ces-d: does race/ethnicity matter? Innov. Aging 1, 1149-1149.

Wasil, A.R., Gillespie, S., Park, S.J., Venturo-Conerly, K.E., Osborn, T.L., Derubeis, R.J., Weisz, J.R., Jones, P.J., 2021. Which symptoms of depression and anxiety are most strongly associated with happiness? A network analysis of Indian and Kenyan adolescents. J. Affect. Disord. 295, 811–821.

Widaman, K.F., Helm, J.L., 2023. Exploratory factor analysis and confirmatory factor analysis In: APA Handbook of Research Methods in psychology: Data analysis and Research Publication, 2nd ed., 3. American Psychological Association, Washington, DC, US.