Psychometric properties of the Center for Epidemiologic Studies Depression Scale in an Egyptian student sample: a preliminary report

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Background
The Center for Epidemiologic Studies Depression Scale (CES-D) is a widely used instrument in the measurement of depression symptoms. Unfortunately, and despite the ubiquity of depression in all regions of the world, the psychometric properties of the CES-D have never been examined in Egyptian samples. The present investigation examined the reliability and validity of the CES-D when used with a sample of Egyptian students.

Methods
This study administered the CES-D, along with two scales designed to test negative cognition (the Cognitive Triad Inventory and the Automatic Thoughts Questionnaire), to a sample of 150 university students in Cairo, Egypt.

Results
The Arabic CES-D possessed adequate internal consistency ($\alpha = 0.88$) and concurrent validity, as evidenced by the significant correlations with the scores on the negative cognition scales. An exploratory factor analysis revealed that a two-factor solution provided the best fit for the data, wherein the first factor represented a fusion of depressive and somatic items.

Conclusion
Given the results of this investigation, the CES-D appears to be a valid instrument when used with a sample of Egyptian students. Consistent with previous research, Egyptians seem to use somatic idioms to describe psychological distress. Limitations and directions for future research are further discussed.

Keywords:
adaptation, Center for Epidemiologic Studies Depression Scale, cross-cultural research, depression, factor analysis, validation

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Introduction

A large body of research indicates that one in five women and one in eight men will experience an episode of a major depressive disorder once in their lifetime [1]. In most cases, individuals experience an elevation in depressive symptoms, such as sadness and feelings of worthlessness, before crossing the threshold into a diagnosable episode [2,3]. On the basis of such ideas, a number of researchers [4] have argued that the detection of subthreshold levels of the disorder is instrumental in the delay or eradication of the detrimental concomitants of depression. For this reason, sensitive screening instruments designed to detect depressive symptoms are of great importance in the fight against the disorder [5].

Despite the scarcity of cross-cultural research examining depression, this condition is prevalent in all regions of the world [6]. Individuals in Arabic-speaking nations have been particularly neglected in the depression literature, despite the soaring rates of the disorder among individuals in this region [7,8]. Given the need to detect early signs of depression and the high prevalence of this condition in Arab nations, validated screening instruments are required for use among individuals of Middle Eastern descent. This study examined the validity and factorial structure of The Center for Epidemiologic Studies Depression Scale (CES-D) [9] among a group of Egyptian university students.

The CES-D was designed in the USA and aimed at the identification of depressive symptomatology in the general population. When used with this population, the scale demonstrated good internal consistency and split-half reliability (0.84 and 0.85, respectively) [9]. Similar psychometric properties have been found with student samples. Factor analysis studies for the CES-D have generally supported a specific four-factor structure (negative/depressive affect, positive affect, somatic/retarded activity, and interpersonal factors) [10].

Some studies indicate that the factorial structure of the CES-D is dependent on the studied population. Support has been found for a three-factor solution with ethnic minority samples. For instance, Guarnaccia *et al.* [11] and Stroup-Benham *et al.* [12] found that the CES-D

evidenced three components when administered to Hispanic samples, as the depressive and somatic domains of the instrument merged together into a singular factor. Kuo [13] and Ying [14] also found support for this three-factor solution in samples of Asian participants.

Given the widespread use of the CES-D in Western samples, the validity of this instrument has also been examined in few Arabic-speaking samples. For instance, Ghubash *et al.* [15] administered an Arabic language version of the CES-D to a sample of women in the United Arab Emirates (UAE) and found internal reliability scores similar to those obtained by Radloff [9]. The scale also successfully discriminated between depressed and non-depressed women, as classified by a structured diagnostic interview. These researchers found that the 'depressed affect' and 'somatic' factors of the CES-D were blended together in one factor in their Arabic sample, producing a three-factor solution for the Arabic version of the CES-D. Similarly, Al-Modallal [16] administered the CES-D to a group of Jordanian women and found that the scale demonstrated good internal reliability. In addition, this researcher found a three-factor solution for the scale in her Jordanian sample. Such factors represented a negative affect, a positive affect, and somatic symptoms. In contrast to the two aforementioned studies, Kazarian and Taher [17] administered the Arabic version of the scale to a community sample of Lebanese adults and found a two-factor structure, comprised of a somatic/depressed affect factor and a factor they entitled the interpersonal/lack of positive affect.

The psychometric properties of the CES-D have never been examined among an Egyptian sample. Given this gap in research, and given the documented rates of depressive symptoms in Middle Eastern regions, we administered the CES-D, along with two other scales which assess a common depressive correlate (i.e. negative cognitions), to a sample of medical students from Cairo University in Egypt. The obtained results permitted an examination of the reliability characteristics of the CES-D, its factor structure, and concurrent validity. Screening instruments for depression are necessary in the prevention, diagnoses, and outcome monitoring of the disorder. As such, validation studies of widely used depression measures, even preliminary in nature, are necessary, especially in a society in which depressive symptoms are at a historical peak.

Methods

Measures

The CES-D ([9]; Appendix A) is a 20-item instrument that was designed to assess the current (defined as in the past week) levels of depressive symptomatology in the general population. Using a '0–3' Likert-type scale, participants specify how much they endorsed statements such as 'I felt everything I did was an effort' and 'I felt depressed'. Total scores on this measure range from 0 to 60, and higher scores indicate greater distress.

The reliability (Cronbach's $\alpha = 0.85$; test–retest = 0.32–0.67) and concurrent validity of the CES-D among community samples has been well established [9,18]. A number of studies have also demonstrated the psychometric soundness of this instrument among university populations. For example, Devins *et al.* [19] found that the CES-D achieved reliability estimates close to those originally derived by Radloff [9] when the instrument was administered to a sample of undergraduate students.

The Automatic Thoughts Questionnaire (ATQ) [20] is a 30-item test designed to assess the frequency of negative automatic thoughts in depression. The instrument instructs respondents to indicate how frequently they thought of the presented statements (e.g. 'I am a failure'; 'I don't think I can go on', etc.) over the last day. The items are negatively valenced and are answered on a five-point Likert scale [from 1 (not at all) to 5 (all the time)]. Total scores range from 30 to 150, and higher scores correspond to a greater frequency of negative thoughts.

The ATQ has been shown to possess good scale score reliability ($\alpha = 0.96$) [20]. Harrell and Ryon [21] found a strong convergent validity for the scale, as it was shown to significantly correlate with the clinician ratings of depression, the Minnesota Multiphasic Personality Inventory Depression scale, as well as with the Beck Depression Inventory [22]. Finally, Hollon *et al.* [23] found that the instrument discriminated between depressed individuals and those who suffer from other psychopathologies. The ATQ has been culturally adapted and utilized in countries such as China [24], Turkey [25], and Japan [26].

The Cognitive Triad Inventory (CTI) [27] is an instrument designed to measure the intensity of negative cognitions toward self, the world, and the future. The scale has a total of 36 items, six of which are nonscored filler items and the remaining 30 form three subscales of 10 items each: view of self, of the world, and of the future. The CTI uses a Likert-style scale [(from 1 (totally agree) to 7 (totally disagree)]. Beckham *et al.* [27] administered the CTI to a group of depressed individuals and found an overall internal consistency of $\alpha = 0.95$. As for CTI's validity, Beckham *et al.* [27] found that the scale was significantly correlated ($r = 0.77$) with the Beck Depression Inventory.

We chose to test the validity of the CES-D against measures of negative thoughts, given that the latter is one of the most widely studied concomitants of depression. As argued by Clark *et al.* [3] although depression and negative thoughts are slightly overlapping, they represent separate constructs nonetheless, and thus it is not tautological to examine them in conjunction of one another.

Procedure and participants

Before the data collection, Arabic versions of all three scales used in the present study were created. They were created in the context of an earlier project and were used in the present study (see Beshai *et al.* [7] for more information on the translation). The procedure recommended by the WHO [28] was used in the translation of

the scales. In particular, forward and back translations were performed with native Arabic speakers until linguistic equivalence was achieved between the two versions of each scale.

Before data collection, approval was obtained from the University of Calgary's Conjoint Faculties Research Ethics Board (CFREB). Further, and although no similar board existed at the time of data collection in the Cairo institution, both the head of the Department of Psychiatry and the dean of the Faculty of Medicine at Cairo University reviewed and approved of the ethical appropriateness of the proposed research and associated consent form. Participants, with ages ranging from 21 to 25 years, were solicited from graduate, medical classes at Cairo University. After obtaining informed consent, the participants completed a demographic information form (gathering information about age, sex, year of study, ethnicity, etc.) followed by the questionnaires listed above in random order.

Results

Demographic information

A total of 210 participants completed the set of measures. As the goal of the study was to examine the psychometric characteristics of the CES-D in an Arabic-speaking sample from Egypt, 50 participants were excluded as they were born outside of Egypt and another eight were excluded as they reported a primary language other than Arabic. Two participants also failed to complete three or more items on the CES-D, and thus the data for these participants were eliminated from further analyses. The remaining sample of 150 participants consisted of 81 (54%) women and 69 (46%) men with a mean age of 22.36 (SD = 0.86) years. The majority of participants ($n = 130/85.5\%$) identified Islam as their religion.

Depressive symptoms and cognition

The mean total scores for the CES-D and the CTI were 21.54 (SD = 10.54) and 85.16 (SD = 22.43), respectively. Women scored significantly higher than men on both the CES-D [$F(1,149) = 17.34$, $P < 0.01$ (partial $\eta^2 = 0.10$)] and the CTI [$F(1,149) = 7.09$, $P < 0.01$ (partial $\eta^2 = 0.05$)]. The mean total score for the ATQ was 61.67 (SD = 19.67).

CES-D reliability estimates

The Arabic version of the CES-D was found to have a Cronbach's α coefficient and Guttman split-half coefficient of 0.88 was 0.87 in the entire sample, respectively. The Arabic version of the CTI possessed a Cronbach's α of 0.90 and a Guttman split-half coefficient of 0.88. The Arabic version of the ATQ possessed Cronbach's α and Guttman split-half coefficients of 0.94 and 0.92, respectively. Thus, the Arabic versions of the scales used in this study possessed adequate scale score reliabilities. The mean values, SDs, and reliability estimates for the CES-D, CTI, and ATQ are provided in Table 1.

Table 1 Mean score, SD, and reliability estimates for the Arabic CES-D, CTI, and ATQ ($N = 150$)

	Mean score (SD)	Cronbach's α	Guttman split-half
CES-D	21.54 (10.54)	0.88	0.87
CTI	85.16 (22.43)	0.90	0.88
ATQ	66.73 (19.66)	0.94	0.92

ATQ, Automatic Thoughts Questionnaire; CES-D, Center for Epidemiologic Studies Depression Scale; CTI, Cognitive Triad Inventory.

CES-D factor analysis

Using data from the entire sample, the 20 items of the Arabic CES-D were subjected to a principle component analysis using SPSS, version 17.0 (IBM Corporation, Armonk, New York, USA). The sampling adequacy was evidenced, as the Kaiser–Meyer–Olkin (KMO) value was 0.86, which exceeded the recommended cutoff value of 0.6 [29]. Moreover, Bartlett's test of sphericity was statistically significant ($P < 0.001$), which supports the factorability of the correlation matrix.

The initial analysis yielded five components with eigenvalues greater than 1. The eigenvalues for these components were 6.46 (32.32% of variance), 1.72 (8.58% of variance), 1.32 (6.58% of variance), 1.21 (6.10% of variance), and 1.04 (5.18% of variance), respectively. Cumulatively, these factors accounted for 58.69% of the variance in the data. A parallel analysis [30] on a random data matrix of 20 variables and 150 cases yielded eigenvalues of 1.73, 1.57, 1.47, 1.38, and 1.30.

As with the original study of Radloff [9], a Varimax rotation was applied to the data to simplify the interpretation. After rotation, five eigenvalues continued to be greater than 1.0: 4.04 (20.18% of variance), 2.43 (12.13% of variance), 1.98 (9.91% of variance), 1.67 (8.36% of variance), and 1.62 (8.11% of variance). The rotation for the five-factor solution converged after 38 iterations.

Different factor solutions were compared to determine the most parsimonious structure. To compare the models, Cattell's [31] scree test and Gorsuch's [32] a-priori cutoff value for substantive loadings (± 0.4) were used. Interpretability of the models was also used to determine factor retention, based on the criteria of the least number of items that substantively loaded onto two or more factors and theoretically meaningful negative loadings. Finally, the decision to retain factors was made in accordance with the previously conducted parallel analysis.

The scree plot of eigenvalues showed a substantive and abrupt descent, beginning at the second factor [31]. Further, a two-factor solution yielded the simplest solution, as only three items had complex (dual) loadings, 19 items loaded substantively onto one or more factors, and the loadings were theoretically meaningful. Moreover, the rotation for the two-factor solution converged after three iterations (compared with 5, 7, and 38 iterations in the three-, four-, and five-factor solutions, respectively). Finally, only two factors in the original, unrotated structure generated eignevalues equal to or greater than the eigenvalues generated by the parallel analysis of the hypothetical data matrix (Horn, 1965), and therefore supporting the retention of no more than two

Table 2 The two-factor varimax solution for the Arabic version of the CES-D

Item	Factor 1	Factor 2
1. Felt bothered	**0.69**	0.03
2. Had poor appetite	**0.65**	−0.15
3. Felt blue	**0.49**	**0.48**
4. Felt as good as others	−0.16	**−0.66**
5. Trouble keeping my mind on what I was doing	**0.45**	0.28
6. Felt depressed	**0.67**	0.38
7. Everything I did was an effort	**0.62**	0.02
8. Felt hopeful	0.03	**−0.62**
9. Life was a failure	0.35	**0.58**
10. Felt fearful	**0.49**	**0.45**
11. Sleep was restless	**0.48**	0.15
12. Felt happy	−0.38	**−0.58**
13. Talked less	**0.45**	0.06
14. Felt lonely	**0.55**	0.32
15. People were unfriendly	0.34	0.27
16. Enjoyed life	−0.17	**−0.63**
17. Had crying spells	**0.53**	0.35
18. Felt sad	**0.61**	**0.53**
19. People disliked me	0.04	**0.52**
20. Couldn't get going	0.36	**0.55**
Eigenvalue (% accounted for)	6.46 (32.31)	1.72 (8.58)

Loadings larger than ±0.4 are given in bold.

factors. Thus, the two-factor solution was found to be the most parsimonious and theoretically coherent, given the data (Table 2). Together, the two retained factors accounted for 40.89% of the variance.

Of the 20 items of the CES-D, 12 of which loaded onto the first of the three factors (1, Felt bothered; 2, Had poor appetite; 3, Felt blue; 5, Trouble keeping my mind on what I was doing; 6, Felt depressed; 7, Everything I did was an effort; 10, Felt fearful; 11, Sleep was restless; 13, Talked less; 14, Felt lonely; 17, Had crying spells; and 18, Felt sad). Ten items also loaded onto the second factor (3, Felt blue; 4, Felt as good as others; 8, Felt hopeful; 9, Thought my life is a failure; 10, Felt fearful; 12, Felt happy; 16, Enjoyed life; 18, Felt sad; 19, People disliked me; and 20, Couldn't get going).

CES-D validity estimates

Correlational analyses revealed that the CES-D was positively correlated to the CTI ($r = 0.73$) and ATQ ($r = 0.67$). Two hierarchical regression analyses were performed to determine whether the CES-D accounted for a substantial amount of variance in both CTI and ATQ scores. In the first analysis, scores on the CTI were used as the dependent variable, whereas the CES-D scores were used as the criterion variable. The regression equation for such an analysis was significant [$F(1,149) = 165.01$, $P < 0.0001$]. The results revealed that the CES-D scores accounted for 53% of the variance in the CTI scores.

The second analysis used scores on the ATQ as the dependent variable. Similar to the first analysis, the CES-D scores functioned as the criterion variable. The final equation evidenced that the CES-D scores accounted for a significant proportion (45.3%) of the variance in the ATQ scores [$F(1,149) = 121.68$, $P < 0.0001$] (Table 3).

Table 3 Summary statistics of the regression analysis on the CTI and ATQ using CES-D as a predictor ($N = 150$)

Criterion variables	R	Change in R^2	β
CTI	0.73	0.53***	1.54
ATQ	0.67	0.45***	1.25

ATQ, Automatic Thoughts Questionnaire; CES-D, Center for Epidemiologic Studies Depression Scale; CTI, Cognitive Triad Inventory.
***$P < 0.0001$.

Discussion

First, it appears that Egyptian students recruited for this sample evidenced a higher mean total score on the CES-D than Western student samples in previous research [33]. Second, the Arabic CES-D used in this study possessed a Cronbach's α of 0.88, evidencing adequate scale score reliability. Finally, and consistent with previous research, the above analyses indicate that scores on the CES-D were not only significantly correlated with known concomitants of depression (i.e. negative cognition), but can also predict a significant proportion of the variance in such concomitants among Egyptian students.

The exploratory factor analysis revealed that the CES-D might be structurally different when used with an Egyptian sample than when used with a North American sample. For example, a mix of depressive and somatic items characterized the first of the two components found. The positive items of the CES-D (item 4, 'Felt as good as others'; item 8, 'Felt hopeful'; item 12, 'Felt happy'; and item 16, 'Enjoyed life') negatively loaded onto the second factor, suggesting that this factor taps a 'lack of positive affect' construct. Thus, the second factor represented a more diffused mixture of depressive, somatic, and interpersonal items (item 15, 'People were unfriendly' and item 19, 'People disliked me').

Using similar methodology, Ghubash *et al.* [15] found that a three-factor solution of the CES-D provided the best fitting model with a sample of UAE students, as the somatic and affective items merged together into one factor in their analysis. Correspondingly, Kazarian and Taher [17] found that depressive and somatic items clustered together in the first factor in their two-component solution of the CES-D obtained with a sample of Lebanese participants. Other researchers [11–14] obtained similar results with non-White samples. This result suggests that most individuals around the world may use somatic and bodily metaphors to express psychological distress. The mind–body distinction that is often made among sufferers in Westernized nations may not be applicable to individuals who suffer from depression in Egypt, as revealed by this study and by others like it [7].

The high scores obtained by the Egyptian students on the CES-D in this study may suggest that, for optimal sensitivity and specificity, the cutoff scores on the CES-D may be slightly raised so as to adjust for sample differences. Indeed, Ghubash *et al.* [15] found that a cutoff score of 21 (in comparison with the widely used score of 16 among Western samples) has the most optimal sensitivity and specificity in her sample of UAE females.

Consistent with previous research [3,34], the results obtained in the present study revealed that a depressive symptomatology, as assessed by the CES-D, predicted the presence and severity of negative cognitions. As such, the Arabic CES-D evidenced construct validity when used with this sample. As mentioned above, although negative cognition is a slightly overlapping construct with depression, both are unique variables and should be studied as such [3].

The present study has a number strengths and limitations. In terms of strengths, this is the first study to perform an exploratory factor analysis with the CES-D in an Egyptian sample. As such, this investigation addresses a vast gap in the depression assessment and cross-cultural psychopathology literature. Second, in contrast to most previous studies that examined the validity of the CES-D in Arabic-speaking samples [15,16], this study employed a mixed sex sample in the analyses. Third, this study adhered to contemporary guidelines [28] in the Arabic adaptation of the utilized materials.

This study suffers from a number of methodological limitations. For instance, the sample used is relatively homogenous (medical students in the same academic year of study), thus generalizations from the obtained results onto other populations are tenuous. Second, although the correlation matrix generated by the analysis was factorable, a larger sample is always preferred for principle component analyses [35]. Third, although an exploratory factor analysis is an important first step in this line of research, confirmatory analysis of the two-factor model of the CES-D is a necessary second step toward validation of this measure of depression among Egyptian populations.

The results obtained in this investigation support the use of the CES-D in a sample of Egyptian students. It appears that the Arabic CES-D is both reliable and valid, and, although it evidenced a different factorial structure than that obtained among White samples, the emergent structure fits the pattern obtained in previous research with diverse samples. Future investigations should test the validity of this instrument in a larger and more diverse sample of Egyptians, as well as use more sophisticated analyses in supporting the obtained results of this exploratory work.

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Conflicts of interest

There are no conflicts of interest.

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Appendix A

Arabic Version of the CES-D

التعليمات: ضع دائرة على رقم محدد لكل عبارة تصف معدل شعورك أو سلوكك بهذه الطريقة خلال الأسبوع الماضى.

	خلال الأسبوع الماضى:	نادراً أو أبداً (أقل من يوم واحد)	بعض الوقت أو قليلاً (يوم إلى يومين)	أحياناً أو قدر معتدل من الوقت (3 4 أيام)	معظم أو كل الوقت (5 7 أيام)
1	كنت أشعر بالضيق من أمور عادةً لا تضايقنى	0	1	2	3
2	لم أرغب فى الأكل، كانت شهيتى للطعام قليلة	0	1	2	3
3	شعرت أنى لا أستطيع التخلص من الحزن حتى مع مساعدة عائلتى وأصدقائى	0	1	2	3
4	شعرت أننى جيد بمثل جودة الآخرين	0	1	2	3
5	شعرت بصعوبة فى التركيز على ما أفعله	0	1	2	3
6	شعرت بالاكتئاب	0	1	2	3
7	شعرت أن كل ما فعلته مجهداً	0	1	2	3
8	شعرت بالأمل فى المستقبل	0	1	2	3
9	فكرت فى أن حياتى فاشلة	0	1	2	3
10	شعرت بالخوف	0	1	2	3
11	كان نومى مؤرق	0	1	2	3
12	كنت سعيداً	0	1	2	3
13	كنت أتكلم أقل من المعتاد	0	1	2	3
14	شعرت بالوحدة	0	1	2	3
15	الناس غير ودودين	0	1	2	3
16	استمتعت بالحياة	0	1	2	3
17	انتابتنى نوبات بكاء	0	1	2	3
18	شعرت بالحزن	0	1	2	3
19	شعرت أن الناس لا يعجبون بى	0	1	2	3
20	لا استطع أن "أواصل"	0	1	2	3