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Psychometric properties of the Moroccan dialect versions of the Perceived Stress Scale and the Center for Epidemiologic Studies Depression Scale among Moroccan university students

Younes RAMI[1*], Hicham KHABBACHE[2], Jamal AMRAOUI[3], Driss AIT ALI[4], Zakaria ABIDLI[5], Abdulmohsen MOHAMMED ABDULLAH ALKHULAYFI[6], Mahmood BAHRAMIZADEH[7], Hassan LAABOUB[8], Amelia RIZZO[9], Bouabid BADAOUI[10], Şeyhmus AKSOY[11], Lukasz SZARPAK[12], Murat YILDIRIM[13], Francesco CHIRICO[14]

Affiliations:
[1]*Applied Psychology, Linguistics and Philosophy Laboratory, Faculty of Humanities-Saïs, Mohammed Ben Abdellah University, Fez, Morocco. E-mail: younes.rami@usmba.ac.ma* **ORCID:** *0000-0003-2313-8734*

[2]*Laboratory of «Morocco: History, Theology and languages, » Department of Psychology, Faculty of Arts and Human Sciences Fès-Saïss, Sidi Mohamed Ben Abdellah University, Fez-Morocco. Director of Lifelong Learning Observatory (UNESCO/ USMBA). E-mail: hicham.khabbache@usmba.ac.ma* **ORCID:** *0000-0001-9587-2829*

[3]*Applied Psychology, Linguistics and Philosophy Laboratory, Faculty of Humanities-Saïs, Mohammed Ben Abdellah University, Fez, Morocco*

[4]*Laboratory of «Morocco: History, Theology and languages, » Department of Psychology, Faculty of Arts and Human Sciences Fès-Saïss, Sidi Mohamed Ben Abdellah University, Fez-Morocco. E-mail: driss.aitali@usmba.ac.ma* **ORCID:** *0000-0001-5043-9677.*

[5]*Health Sciences, Education and Management Laboratory, Higher Institutes of Nursing and Health Technique, Casablanca. E-mail: zakaria.abidli@uit.ac.ma* **ORCID:** *0000-0003-2218-0447*

[6] *Department of Business Administration, Faculty of Economics and Administration, King Abdul-Aziz University, Jeddah, Saudi Arabia. E-mail: aalkhlife@kau.edu.sa* **ORCID:** *0009-0009-7333-8161*

[7]*Orthotics and Prosthetics Department, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. E-mail: ma.bahramizadeh@uswr.ac.ir* **ORCID:** *0000-0003-4719-938X*

[8]*Applied Psychology, Linguistics and Philosophy Laboratory, Faculty of Humanities-Saïs, Mohammed Ben Abdellah University, Fez, Morocco. E-mail: hassan.laaboub@usmba.ac.ma* **ORCID:** *0009-0002-0317-4308*

[9]*Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy. Medical-Legal Center of the National Institute of Social Welfare, Messina, Italy. E-mail: amrizzo@unime.it* **ORCID:** *0000-0002-6229-6463*

[10]*Biodiversity, Ecology and Genome Laboratory, 4 Avenue Ibn Battouta, Faculty of Sciences, Mohammed V University in Rabat, B.P. 1014 Morocco. E-mail: bouabidbadaoui@gmail.com* **ORCID:** *0000-0001-6808-1765*

[11]*Department of Psychology, Faculty of Science and Letters, Agri Ibrahim Cecen University, Ağrı, Türkiye. E-mail: seaksoy@agri.edu.tr* **ORCID:** *0000-0001-6637-4126*

[12]*Department of Clinical Research and Development, LUXMED Group, Warsaw, Poland. Institute of Medical Science, Collegium Medicum, The John Paul II Catholic University of Lublin, Lubin, Poland. Henry JN Taub Department of Emergency Medicine, Baylor College of Medicine, Houston, TX, USA. E-mail: lukasz.szarpak@gmail.com* **ORCID:** *0000-0002-0973-5455.*

[13]*Department of Psychology, Faculty of Science and Letters, Agri Ibrahim Cecen University, Ağrı, Türkiye. Psychology Research Centre, Khazar University, Baku, Azerbaijan. E-mail: muratyildirim@agri.edu.tr* **ORCID:** *0000-0003-1089-1380*

[14]*Post-Graduate School of Occupational Health, Università Cattolica del Sacro Cuore, Rome, Italy. Health Service Department, Italian State Police, Ministry of the Interior, Milan, Italy. E-mail: francesco.chirico@unicatt.it* **ORCID:** *0000-0002-8737-4368*

Corresponding Author:

Younes Rami, Applied Psychology, Linguistics and Philosophy Laboratory, Faculty of Humanitie-Saiss, Mohammed Ben Abdellah University in Fez, B.P.59 Route Immouzer CP 30000 Morocco.

Abstract

Introduction: This study investigates the psychometric properties of the Moroccan dialect versions of the Perceived Stress Scale (PSS-10) and the Center for Epidemiologic Studies Depression Scale (CES-D-10) in a sample of Moroccan university students. The objective is to evaluate the reliability and validity of these scales for assessing perceived stress and depressive symptoms among this population.

Methods: We conducted a cross-sectional survey of 204 Moroccan university students. Stress and depression levels were measured using the PSS-10 and the CES-D-10. The psychometric properties of the PSS-10 and CES-D-10 were assessed based on internal consistency, internal coherence, and confirmatory factor analyses.

Results: The study demonstrated an adequate fit for the PSS-10 ($\chi^2(25) = 44.591$, CFI = 0.989, TLI = 0.985, SRMR = 0.058) and CES-D-10 ($\chi^2(25) = 62.993$, CFI = 0.955, TLI = 0.942, SRMR = 0.046) scales. Additionally, the PSS-10 and CES-D10 exhibited significant correlation ($r = .75$, $p < .01$) further reinforcing their convergent validity.

Discussion: Consistent with previous research, the internal consistency, internal coherence, and confirmatory factor analyses were satisfactory for both the PSS-10 and CES-D-10 in the Moroccan university context. These findings suggest that the PSS-10 and CES-D10 are robust tools for assessing perceived stress and depression, making them valuable instruments for researchers and clinicians in the field of mental health.

Take-home message: This study provides university psychologists with reliable short tools for measuring stress and depression in a brief timeframe.

Keywords: CESD-10; depression, Moroccan university students; PSS-10; stress; psychometric properties.

INTRODUCTION

Mental health among students is a growing concern worldwide, as academic pressures, social transitions, and personal challenges can significantly impact their psychological well-being and their academic performances [1–3]. In particular, mental health issues such as anxiety, depression, and stress are commonly reported among university and high school students [3], often resulting in academic difficulties, emotional distress, and, in some cases, school dropout [3,4]. On the same line, Rizzo et al. highlight the influence of addiction on the mental health of students [5]. Other studies have shown that factors such as social support, self-esteem, and coping mechanisms play key roles in mediating mental health outcomes in students [6]. The importance of creating a supportive educational environment that promotes emotional well-being, and mental health has been highlighted in recent research [7], with some studies focusing on the role of metacognitive learning strategies in improving academic performance and mental health among Moroccan students [8].

In the Moroccan context, mental health issues among students have gained attention due to the increasing recognition of their impact on academic success and overall quality of life. Research has

shown that Moroccan students face unique challenges, including high levels of stress [9], anxiety [10], and academic burnout [11], which are exacerbated by societal expectations and the pressure to succeed [11]. Despite these challenges, there is a significant gap in research regarding the psychometric evaluation of mental health assessment tools specifically tailored for the Moroccan population. This gap highlights the need for validated scales that take into account the linguistic and cultural nuances of the Moroccan context, to ensure that mental health assessments are both accurate and applicable to this population [12,13]. Addressing this need is critical for supporting the mental health of Moroccan students and promoting their academic and personal success.

The Perceived Stress Scale (PSS-10) and the Center for Epidemiologic Studies Depression Scale (CES-D-10) serve as reliable tools to assess stress and mood disorders, respectively. Accurate assessment tools are essential for identifying and addressing these challenges, enabling timely interventions that support student well-being. Multiple studies have confirmed strong psychometric properties of the PSS-10 and the CESD-10. Based on the transactional perspective of stress formulated by Lazarus Folkman [14], the Perceived Stress Scale (PSS) provides a global assessment of perceived stress based on individuals' cognitive appraisal of their ability to cope with non-specific, unpredictable. Originally composed of 14 items, with 7 measuring positive perceptions and seven negative perceptions, the first version of the scale was reduced by deleting four items with insufficient factor loadings, according to the factor analysis carried out by Cohen [15]. The shortened version, PSS-10, considered the most effective, has been extensively studied in various linguistic contexts, confirming its intercultural stability and flexibility of adaptation. Furthermore, it should be noted that PSS-10 has been validated in different groups, ranging from healthy individuals [15–20] to patients [21–23]. Regarding its factorial structure, some studies support a unidimensional structure [24], while others suggest a bi-dimensional structure [24–27]. In addition, various perspectives are emerging, such as considering perceived stress as bifactorial models reflecting a multidimensional scale structure [28–30]. Studies converging on a two-factor structure differ in their interpretation of the two factors. Some researchers argue for a distinction between negative and positive formulations of the items [27], while others maintain that both factors refer to distress and coping strategies [31].

The Centre of Epidemiological Study of Depression Scale (CESD) was designed by researchers affiliated with the Center for Epidemiological Studies at the U.S. National Institute of Mental Health to measure depressive symptoms in adults from the general population [32]. It consists of 20 items assessing affective and somatic symptoms [33] associated with depression. Initial factor analyses of the CESD scale [32] revealed a multi-dimensional structure comprising four distinct factors. These factors are depressed affect, positive affect, somatic symptoms, and interpersonal problems. Subsequently, other studies have proposed higher-order models highlighting interrelationships between these four measured factors [34,35]. In the French context, research carried out with clinical and non-clinical adult samples [36] and with adolescents [37] has demonstrated the scale's good psychometric properties and also confirmed the four factors previously identified [36]. In contrast, Chabrol et al. [38] highlighted four other factors distinct from the previous ones. These are depressive cognition (items 1, 9, 10, 15, 19), positive affect (items 4, 8, 12, 16), slowing down (items 5, 7, 20), and depressive affect (items 2, 3, 6, 11, 14, 17, 18). Various shortened versions of the CESD scale, comprising between 10 and 11 items, have been proposed for use with older people [39–42]. For example, a 10-item version [40] comprises three factors: depressive affect (3 items), somatic symptoms (5 items), and positive affect (2 items).

The study aims

Despite the existence of a body of work supporting the factorial structure of the PSS-10 and the CES-D-10, the few studies conducted in the Moroccan context have only explored the factorial structure through exploratory factor analysis. Regarding the PSS-10 only Ksiksou et al [43] have tested its factorial structure by using a confirmatory factor analysis (CFA), while no study addressed a confirmatory factor analysis on the CESD-10. This gap poses a challenge in assessing the psychometric quality of these two scales within the Moroccan population. The availability of suitable tools that account for linguistic and cultural nuances is essential to capture the subjective experiences

of stress and depression accurately. Without validated Moroccan versions, the reliability and validity of results for these populations may be compromised, limiting their applicability in both research and clinical practice. Addressing this gap is crucial to ensuring that these widely used tools can fulfil their potential in assessing and supporting mental health across diverse cultural contexts [44-54]. In this regard, the present study aims to evaluate the factorial structure of the Moroccan dialect versions of the PSS-10 and CES-D-10 in a sample of Moroccan university students. Based on previous research, we hypothesize that the Perceived Stress Scale among Moroccan students will likely demonstrate a two-factor model. Additionally, the CESD scale among Moroccan students is expected to reveal a multidimensional structure comprising distinct but interrelated dimensions, including depressive cognition, positive affect, slowing down, depressive affect, and somatic symptoms. These hypotheses aim to explore the underlying factorial structures of these scales within the context of Moroccan students.

METHODS

Study design and procedure

This study employed a cross-sectional survey design to examine the psychometric properties of the PSS-10 and the CES-D-10. To ensure cultural relevance for Moroccan participants, we conducted a dialectical cultural adaptation. This rigorous process allowed us to develop a culturally adapted Moroccan version of the PSS-10 while ensuring linguistic accuracy and conceptual equivalence. The Moroccan version of the PSS-10 was designed to minimize administration time while assessing how individuals perceived stressful events over the past month. This translation and validation process ensures that the scale is both culturally appropriate and effective within the Moroccan context.

Study participants and sampling

This study involves 204 Moroccan university students recruited using convenience sampling methods. The exclusion criteria required that only students without pre-existing mental health disorders or psychiatric histories could participate.

Study instruments

Perceived Stress Scale (PSS-10) was used to evaluate perceived stress. The scale consists of ten items, with five response options on a Likert scale: *never (0), almost never (1), sometimes (2), often (3), and very often (4)*. Six of these items (1, 2, 3, 6, 9, and 10) are considered negative and measure levels of distress, while the remaining four items (4, 5, 7, and 8) assess an individual's perceived coping ability. In calculating the total PSS-10 score, the positive items were reverse-coded. The overall score ranges from 0 to 40, with higher scores indicating higher stress levels.

Center of Epidemiological Studies — Depression (CES-D) was used to assess depression [40]. This brief version comprises 10 items that evaluate depressive mood over the past week, focusing on both emotional and physical symptoms linked to depression. Participants indicated how often they experienced each symptom on a scale ranging from rarely (0), occasionally (1), moderately (2), to frequently (3). Total scores range from 0 to 30, with higher scores indicating more severe levels of depression.

Ethical aspects

The research was approved by the Institutional Ethics Review Board of the Department of Applied Psychology at the Faculty of Arts and Human Sciences in Fez, Morocco, in January 2023 (approval number 13/2023). Before data collection, the researchers followed ethical guidelines, which included obtaining administrative authorization for the study, clearly explaining its objectives to the participating students, ensuring their anonymity, securing their consent, and maintaining the confidentiality of the data collected.

Data analysis

The validation of the measurement scales was based on internal consistency, internal coherence, and confirmatory factor analyses. Internal consistency was assessed on each dimension by Cronbach's alpha coefficient (score fidelity). Internal consistency was assessed by inter-item correlations within the same dimension, and by the correlation of each item with its dimension using Pearson's coefficient (internal reliability). According to Carey and Seibert [55], a Cronbach's alpha

value of 0.7 or more is acceptable, while a correlation of 0.4 or more is recommended. We carried out confirmatory factor analyses using structural equation methods (SEM). This technique enables us to test the validity of the construct and determine a better factor structure for the measurement scale [56]. A good fit between empirical and estimated data will be reflected in absolute indices (Chi-square, GFI, AGFI, SRMR, and RMSEA) and incremental indices (NFI, CFI, and RFI). In line with the recommendations of Hu and Bentler [57,58], the cut-off values for these suitability indices are as follows: for CFI and TLI, values above 0.95 are considered suitable; for SRMR, values below 0.08 are suitable. Data analysis was conducted using Stata statistical software [59].

RESULTS

The sample comprised 56 male students (27.45%) and 148 female students (72.55%). Participants were divided into three age categories: 57.5% were aged between 22 and 25 years, 38.1% were between 17 and 21 years, and 4.4% fell into the 24 to 28-year range. In terms of academic levels, 82.2% of students were pursuing bachelor's degrees, 7.1% were enrolled in master's programs, and 0.9% were undertaking doctoral studies.

For the PSS-10, Cronbach's alpha coefficients revealed good internal consistency for the scale as a whole (alpha= 0.847), as well as for the negative (alpha= 0.773) and positive (alpha= 0.869) perception subscales. Correlations between individual items and the total score for each factor ranged from 0.360 to 0.704, well above the commonly adopted cut-off criteria (> 0.40;[46]). Only item 4 showed a modest correlation with the total scale score ($r = 0.215$). Inter-item correlations ranged from 0.364 to 0.628 for the first factor and from 0.414 to 0.700 for the second factor. Consequently, all scale items were maintained. It is also important to note that the scale items showed close correlations with each other (from 0.83 to 0.87). In light of this, our findings suggest that the scale demonstrates good reliability and well-established internal consistency. The results of the confirmatory factor analysis confirmed the two-factor model for PSS-10. The fit indices mentioned below for the factor structure, including the one-factor and two-factor models, are presented in Table 2.

Table 1. Descriptive statistics, item-total correlations, and Cronbach's Alpha if item deleted for the PSS-10 and CES-D-10 scales.

Scale	Item	Mean	SD	Item-Total correlation	Alpha if item deleted
PSS-10					
	S_Item1	2.181	1.088	0.783	0.817
	S_Item2	2.078	1.052	0.703	0.827
	S_Item3	2.392	1.052	0.763	0.819
	S_Item4	1.975	1.019	0.360	0.861
	S_Item5	2.319	0.883	0.601	0.836
	S_Item6	1.985	1.019	0.605	0.837
	S_Item7	2.181	0.932	0.480	0.848
	S_Item8	2.319	0.911	0.597	0.837
	S_Item9	2.250	1.037	0.747	0.821
	S_Item10	2.196	1.123	0.803	0.814
CESD-10					
	D_Item1	1.230	0.921	0.632	0.836
	D_Item5	1.696	1.000	0.636	0.836
	D_Item6	1.520	1.076	0.801	0.817

D_Item7	2.196	0.905	0.498	0.847
D_Item8	1.152	1.023	0.543	0.846
D_Item10	1.373	1.054	0.809	0.816
D_Item11	1.397	1.112	0.686	0.831
D_Item12	0.897	0.933	0.530	0.845
D_Item14	1.662	1.113	0.686	0.831
D_Item20	1.495	1.071	0.653	0.835

As shown in Table 2, the one-factor model (Model A) yielded unsatisfactory fit indices ($\chi 2(25)$ = 238.106, $p < 0.001$, CFI = 0.782, TLI = 0.72, SRMR = 0.127). In contrast, the two-factor model (Model B) demonstrated a good fit ($\chi 2(25)$ = 44.591, $p > 0.05$, CFI = 0.989, TLI = 0.985, SRMR = 0.058). Figure 1 illustrates that all factor loadings for both factors were significant and greater than 0.3. The ten items of the PSS scale were assigned to two distinct factors: items 1, 2, 3, 6, 9, and 10 loaded onto the first factor, while items 4, 5, 7, and 8 loaded onto the second factor. The model also revealed a moderate correlation between the two factors (0.33). Based on these findings, the results support the two-factor model, labeled "negative perception" and "positive perception," as the best-fitting model.

Table 2. Indices of confirmatory factor analysis for the PSS-10 and CES-D-10 scales.

Scale	Model	$\chi 2$	df	CFI	TLI	SRMR
PSS-10						
	Model A	238.106	35	0.782	0.72	0.127
	Model B	44.591	34	0.989	0.985	0.058
CESD-10						
	Model C	71.63	35	0.954	0.941	0.046
	Model D	62.993	34	0.955	0.942	0.046
	Model E	54.329	33	0.967	0.956	0.041

For the CES-D-10, Cronbach's alpha coefficients indicated strong internal consistency ($\alpha = 0.85$). The correlations between individual items and the total score ranged from 0.45 to 0.75, all exceeding the commonly accepted threshold of 0.40 [46]. As a result, all items of the scale were retained. Additionally, the items exhibited high inter-item correlations, ranging from 0.83 to 0.87. These findings suggest that the scale demonstrates good reliability and robust internal consistency.

Confirmatory factor analysis (CFA) results supported a two-factor model for the CES-D-10. The fit indices for the one-factor (Model C), two-factor (Model D), and three-factor (Model E) models are presented in Table 2. The initial one-factor CFA model (Model C) showed an acceptable fit to the data ($\chi 2(35)$ = 71.630, $p < 0.01$, CFI = 0.954, TLI = 0.941, SRMR = 0.046). The two-factor model (Model D) ($\chi 2(25)$ = 62.993, $p < 0.001$, CFI = 0.955, TLI = 0.942, SRMR = 0.046) and the three-factor model (Model E) ($\chi 2(25)$ = 54.329, $p < 0.001$, CFI = 0.967, TLI = 0.956, SRMR = 0.041) demonstrated even better fit indices than the one-factor model (Model C). Although the three-factor model (Model E) displayed

favourable fit statistics, the two-factor model (Model D) was found to be more appropriate for capturing the underlying structure of the scale. Notably, the three-factor model (Model E) showed a perfect correlation (r = 1, p < 0.001) between the depressive affect (DA) and somatic symptoms (SS) factors.

A higher-order analysis was conducted in response to this finding, but the results indicated that the model did not converge. Given this, we recommend that the two-factor model (Model D), which includes depressive affect (DA) and somatic symptoms (SS) in the first factor and positive affect (PA) in the second factor, be considered the optimal model for our data.

For convergent validity, the Pearson correlation between the two scale scores was found to be high and statistically significant (r = .75, *p* < .001).

Figure 1. Confirmatory factor analysis for the PSS-10 (left panel) and the CESD-10 (right panel).
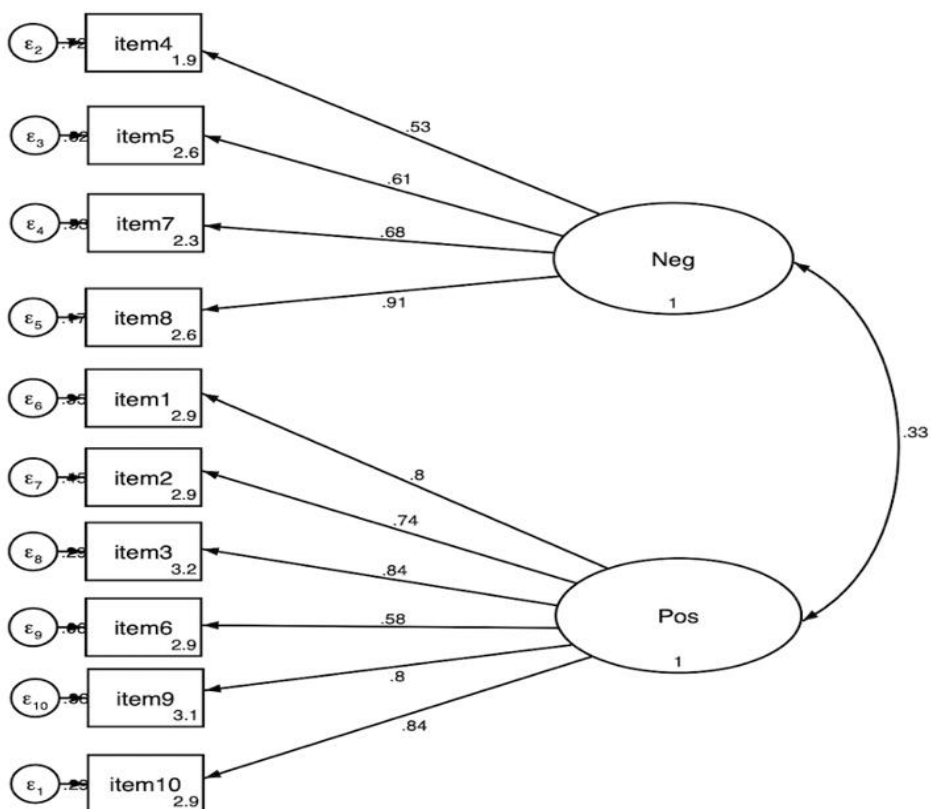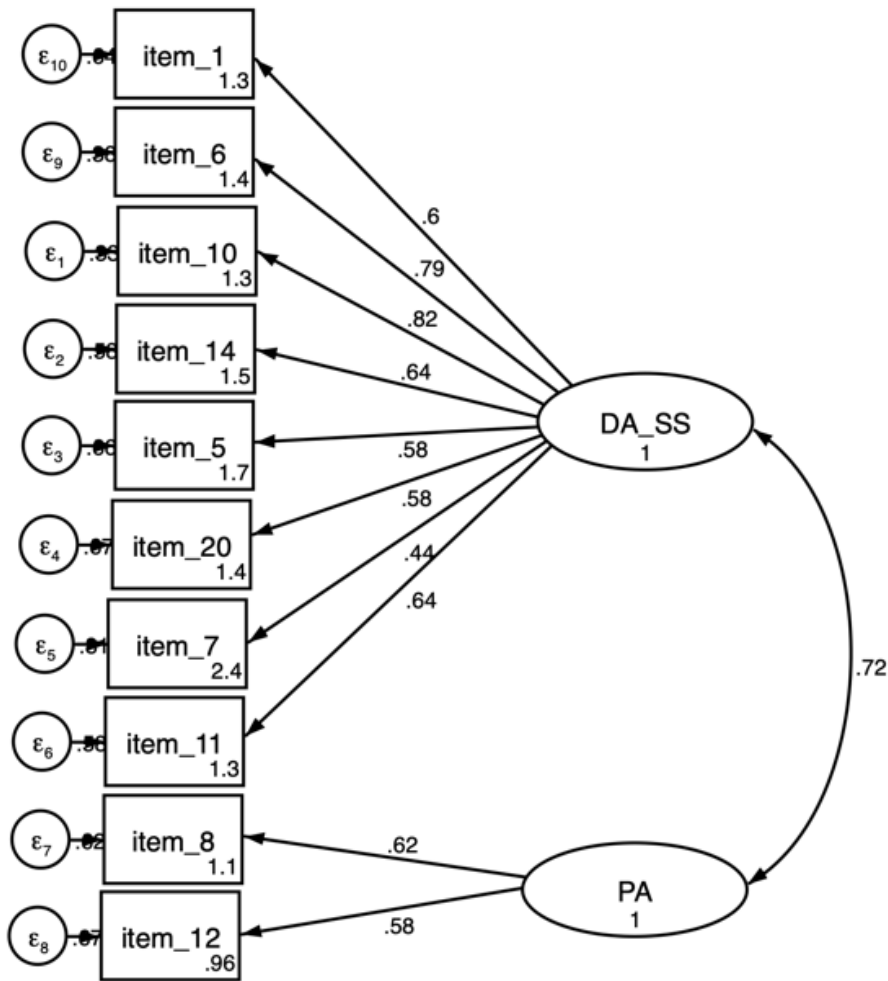
DISCUSSION

Mental health challenges among Moroccan students have gained increasing attention due to their significant impact on academic achievement and overall well-being. Research indicates that Moroccan students face distinct obstacles, including high levels of stress [9], anxiety [10], and academic burnout [11], all of which are further compounded by societal expectations and pressure to succeed [11]. Despite these challenges, there is a critical gap in research on the psychometric evaluation of mental health assessment tools specifically adapted to the Moroccan context. This highlights the need for validated instruments that consider the cultural and linguistic characteristics of Morocco to ensure accurate and contextually relevant assessments [12,13].

While substantial evidence supports the factorial structure of the PSS-10 [27,60,61,62] and the CES-D-10 [34,36,41,42,63,64], studies conducted in Morocco have largely relied on exploratory factor analysis. In particular, only Ksiksou et al. [43] have examined the factorial structure of the PSS-10, and no research has yet conducted a confirmatory factor analysis (CFA) on the CES-D-10 in the Moroccan population, highlighting a key gap in psychometric research.

Cohen et al. [15] initially proposed a unidimensional structure for the Perceived Stress Scale (PSS). However, the introduction of a two-factor model [16] revealed discrepancies between the theoretical [15] and psychometric models [16]. For example, Lee & Jeong [58] identified two factors: "positive stress or perceived efficacy" and "negative stress or perceived helplessness." On the other hand, some studies suggest a three-factor structure. For instance, Pangtey et al. [60] proposed three factors: "perceived helplessness," "perceived distress," and "self-efficacy for management." Similarly, Bradbury [61] put forward a three- factor model comprising "distress," "management," and "emotional reactivity." In our study, confirmatory factor analysis (CFA) revealed a correlated two-factor structure for the PSS-10 among Moroccan students, consistent with findings from previous

studies in other contexts [20,58,64]. Additionally, the internal reliability of the PSS-10, as indicated by a Cronbach's alpha greater than 0.7, supports the scale's robustness.

Regarding the CES-D-10, our analysis of Moroccan students supports a correlated two-factor model. These findings are in line with other studies examining the relationships between the Positive Affect (PA) items and other CES-D-10 items. For instance, Andresen et al. [40] found that the Depressive Affect (DA) and Somatic Symptoms (SS) dimensions clustered together on the first factor, while the Positive Affect (PA) dimension formed a separate cluster on the second factor, based on a large sample of older adults. This result was also confirmed by Boey [63], who identified a two-factor (orthogonal) structure in a large Hong Kong sample. Overall, factor analyses of both the 20-item and 10-item versions of the CES-D indicate that the PA items do not group with the other CES-D components. Some studies have even suggested removing the PA dimension. For example, Turvey et al. [64] excluded PA items from the CES-D-10 altogether. Our preference for a two-factor structure is based on the observation that the three-factor model showed a perfect correlation (r = 1) between the Depressive Affect (DA) and Somatic Symptoms (SS) factors. Attempts to fit a second-order model were not successful, which may be attributed to our sample size. Future research should include a larger sample to further test the second-order model [41]. Overall, the CES-D-10 demonstrated good internal reliability, supporting its psychometric robustness.

The findings related to the Moroccan versions of PSS10 and CESD10 underscore their robust psychometric properties, affirming their reliability and validity for assessing stress and depression levels in the Moroccan student population. These results not only support the scales' use in research but also their practical utility in clinical settings, offering valuable tools for the early detection and monitoring of stress and depressive symptoms. Given their strong psychometric foundations, the PSS10 and CESD10 can play a pivotal role in informing targeted interventions and mental health strategies [65-69].

CONCLUSIONS

The findings indicate that the PSS-10 and the CESD-10 scales exhibit good internal consistency. These tools are therefore valuable for researchers and clinicians in the assessment and monitoring of mental health issues. However, several limitations should be acknowledged. First, the majority of participants in the study come from a homogeneous sample, which limits the generalizability of the results to more diverse populations. Additionally, the use of self-reported measures may introduce response bias, as participants may tend to underestimate or overestimate their symptoms. Longitudinal research and studies in varied cultural contexts are necessary to further enhance our understanding of these scales and their clinical utility.
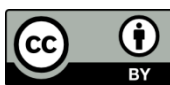
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