

Validity and reliability of SISCO inventory of academic stress among health students in Chile

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Abstract

Objective: To evaluate the factorial structure and internal consistency of SISCO inventory of academic stress in medical students.

Methods: The cross-sectional study was conducted at the School of Medicine, University of Concepcion, Chile, in 2014, and comprised second and third year students. Exploratory factor analysis was carried out to determine the reliability of each of the dimensions of SISCO inventory. Descriptive and correlational analyses were also conducted.

Results: Of the 155 students, 121 (78.1%) were female. The overall mean age was 20.5 +/- 1.55 years (range: 18.9-32.2 years). Of the total, 61 (39.4%) students were in the nursing programme, 10 (6.5%) in speech therapy, 16 (10.3%) in kinesiology, 10 (6.5%) in medicine, 20 (12.9%) in midwifery and 38 (24.4%) in medical technology. For stressor, somatisation and coping dimensions, a factor was identified, with Cronbach's alpha values of 0.76, 0.86 and 0.52, respectively. Correlation could only be established between the first two dimensions.

Conclusion: Stressors and somatisation dimensions of the SISCO inventory of academic stress were found to be validity and reliable.

Keywords: Academic stress, SISCO inventory, Psychometrics, Somatisation, Coping. (JPMA 68: 1759; 2018)

Introduction

The psychological, neurological, immune and endocrine systems work collectively as the control mechanism for homeostasis. 'Stress' is a neuroendocrine, immune and behavioural response of the body to any demand placed upon it, which arises as a result of an interpretation of threat or danger, enabling the adaptation and survival of the living being.¹ The trigger factor of this adaptive response is called a stressor.²

Stress is a complex multifactor process in pathophysiological genesis, whose somatic expression can include gastrointestinal (GI) disturbances, obesity, adjustment disorders, depression and others.³ When this arises in the context of an educational process, it is referred to as academic stress (AS).⁴

Various studies have shown that AS occurs in elementary students and increases as the student progresses through educational levels,⁴ reaching its highest levels in college.⁵ Higher education is the point at which AS becomes a response to the higher workload and coincides with the process of separation from the family, joining the job

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market and adaptation to an unusual environment. The university student population is a group that is subjected to homogenous activity with particularly stressful periods, resulting in exhaustion, reduced interest in studies and difficulties in dealing with their own environmental challenges.

AS has been described as a systematic process of adaptive nature and essentially psychological, presented descriptively in three stages: (i) The student is subjected to a series of demands, which under the assessment of the student, are considered stressors. (ii) These stressors lead to a systemic imbalance (stressful situation), manifested in several symptoms (indicators of imbalance). (iii) This systemic imbalance forces the student to take action to restore the coping system balance.⁶ The existence of three procedural systemic AS components have been recognised: (i) stressor stimuli (input), (ii) symptoms suggestive of systemic imbalance, and (iii) coping strategies (output).⁶ Based on this theoretical model, a self-descriptive psychometric instrument of 31 items was developed called the SISCO inventory of academic stress (SISCO-AS).⁷ It was validated in Mexico and then later in Colombia among university populations.^{8,9}

SISCO-AS has also been used in several studies,^{7,10,11} showing good reliability with Cronbach's alpha values between 0.861 and 0.9. However, there are few validation results using this instrument, including in Latin America. In Chile no study has been done on its

psychometric properties.

When SISCO-AS was presented as a three-dimensional construct of AS from a cognitivist systemic perspective with good psychometric properties,⁷ it supported the idea that each dimension functioned as a factor. Thus, the current study was planned to examine each dimension separately to determine the references to each of the conceptually different variables. This is the first study in Chile to assess the validity and reliability of the construct.

Subjects and Methods

The cross-sectional study was conducted at the School of Medicine, University of Concepcion, Chile, in the first semester of 2014, and comprised second and third year students who were enrolled following short briefings during a mandatory class. Those who volunteered to participate and signed the consent form were included using convenience sampling. After approval was obtained from the institutional ethics committee, SISCO-AS was applied on the sample. SISCO-AS comprises 31 items.⁷ The first is an initial filter, in dichotomous terms (yes-no), for determining whether the respondent will continue or not. The second item, with a single question, aims to identify the overall self-perceived level of AS. The third part has eight items to identify the frequency at which the environmental demands are valued as stressor stimuli. The fourth part consists of 15 items and identifies the frequency of symptoms or reactions to the stressor stimulus. Lastly, the fifth part has six items aiming to identify the frequency with which the individual uses coping strategies. Except the first part, all parts use a five-number value system similar to the Likert scale (1–5; 1=never; 2=very rarely; 3=sometimes; 4=almost always; 5=always).

To obtain evidence of validity associated with SISCO-AS construct, the factor structure of each part was analysed separately: stressors, somatisation and coping strategies were taken as different variables that could be used as independent instruments.

Exploratory Factor Analysis (EFA) is a statistical methodology of interdependence that aims to establish an underlying structure among the analysis variables, through correlation structures between them, defining groups of variables (factors) that are highly correlated with each other.¹² For EFA, the principal axis method of factor extraction recommended for this type of instrument was used.^{12,13} The adequacy of the EFA in collecting data was analysed using the Bartlett's test sphericity for statistical significance ($p < 0.05$), and the Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy, which should be close to 1.0. Three

complementary criteria were used to identify the number of factors: (i) the Kaiser-Guttman criterion, or latent root, and (ii) the contrast fall criterion or Cattell (scree test), which are generally used for this purpose,¹² were added to the result of (iii) the Horn's Parallel Analysis (based on 5000 random samples). These are considered the most suitable tools for the purpose of a study like the current one.¹⁴ Once the number of factors was established, an array configuration using the EFA with the direct Oblimin rotation method was used to determine the organisation of items, including a factor structure. A value of 0.3 was considered the minimum value to accept as an adequate load factor.^{12,15,16}

Once the factors were identified, Cronbach's alpha coefficient reliability was calculated for each to estimate their internal consistency. Subsequently, the discriminative capacity of the items was analysed by calculating the correlation of each with the total fixed factor to which they were assigned.

Lastly, the factors were descriptively analysed, evaluating the correlation between them using the Pearson coefficient. $P < 0.05$ was considered statistically significant. For data analysis, SPSS 22.0 was used.

Results

Of the 166 students enrolled, 155 (93.3%) completed the instrument. Of them, 121 (78.1%) were female. The overall mean age was 20.5 ± 1.55 years (range: 18.9–32.2 years). Of the total, 61 (39.4%) students were in the nursing programme, 10 (6.5%) in speech therapy, 16 (10.3%) in kinesiology, 10 (6.5%) in medicine, 20 (12.9%) in midwifery and 38 (24.4%) in medical technology. For the dimension of stressors, the KMO statistic (0.80) and the Bartlett's test ($p < 0.001$) showed that EFA was pertinent. Kaiser-Guttman's criteria identified two factors with eigen values of 3.12 and 1.03, which explains 51.90% of total variance of the items. The scree test showed one factor through sedimentation graph, and the Horn's parallel analysis indicated one factor with an eigen value of 3.12 which was above the eigen values obtained by 95% (95th percentile) of the random samples. The Cronbach's alpha was $\alpha = 0.762$, with correlation between the items and the total corrected from $r = 0.38$ (item 3.1) to $r = 0.56$ (item 3.5).

For the dimension of somatisation, the KMO statistic (0.87) and the Bartlett's test ($p < 0.001$) showed that the factor analysis was appropriate for the data. Kaiser-Guttman criterion identified four factors with initial eigen values greater than 1.0 (5.20, 1.32, 1.08, and 1.02) that explains 61.62% total variance of the items. The scree test identified one factor, and the Horn's parallel analysis

Table-1: Configuration matrix of the SISCO Inventory of Academic Stress.

Dimension of Stressors		Factor ^a
	Item	
3.1	Competition with others in group	0.430 ^b
3.2	Overload of tasks and academic papers	0.527
3.3	Personality and character of professors	0.601
3.4	Evaluation of professors (exams, tests, research, etc.)	0.665
3.5	Type of work that professors request (consult maps, worksheets, tests, concepts maps, etc.)	0.687
3.6	Do not understand topics covered in class	0.392
3.7	Participation in class (response to questions, exhibitions, etc.)	0.404
3.8	Limited time to do work	0.643
	Eigenvalue	3.12
	% Explained total variance	30.88
Dimension of Somatization		Factor ^a
	Item	
4.1	Sleep disorders (insomnia or nightmares)	0.427
4.2	Chronic fatigue (permanent fatigue)	0.690
4.3	Headaches or migraines	0.423
4.4	Digestive problems, abdominal pain, diarrhea	0.340
4.5	Scratching, nail biting, rubbing, etc.	0.324
4.6	Drowsiness or increased need for sleep.	0.573
4.7	Restlessness (inability to relax and be calm)	0.645
4.8	Feelings of depression and sadness (depressed)	0.694
4.9	Anxiety, anguish or desperation	0.744
4.10	Feelings of aggressiveness or increased irritability	0.677
4.11	Conflict or tendency to argue or debate	0.601
4.12	Isolation from others	0.595
4.13	Unwillingness to perform student duties	0.595
4.14	Increased or decreased food consumption	0.468
	Eigenvalue	5.20
	% Explained total variance	37.14
Dimension of Coping		Factor ^a
	Item	
5.1	Assertive ability (to defend preferences or feelings without harming others)	0.373
5.2	Development of a plan to perform your tasks	0.533
5.3	Compliments oneself	0.503
5.6	Ventilation and confidences (verbalization of the concerned situation)	0.431
	Eigenvalue	1.64
	% Explained total variance	40.87
Factor analysis of second order		Factor ^a
	Stressors	0.888
	Somatization	0.878
	Coping	-0.171
	Eigenvalue	1.59
	% Explained total variance	52.99

identified one factor with an eigen value of 5.20 which was above the 95th percentile of the values obtained in random samples. The Cronbach's alpha was $\alpha=0.858$, with correlation between the items and the total corrected from $r=0.31$ (item without harming others 4.5) to $r=0.67$ (item 4.9).

For the dimension of coping, although the KMO statistic was low (0.55), we proceeded with the EFA given the Bartlett's test value ($p<0.001$). Kaiser-Guttman criterion identified two factors with initial eigen values greater than 1.0 (1.68 and 1.08) that explains 45.92% total variance of the items. The scree test identified one factor and the Horn's parallel analysis identified one factor with eigen value of 1.68 which was above the 95th percentile of the values obtained in the random samples.

The factor loadings indicated that all items, except items 5.4 (religious practice - prayer or church attendance) and 5.5 (Information search on the situation), showed a configuration coefficient greater than 0.3. Item 5.4 was eliminated and the analysis was repeated but there was no change in values. For the remaining four items, the analysis was considered plausible (KMO=0.60; $p<0.001$). The Kaiser-Guttman criterion identified a factor with an initial eigen value higher than 1.0 (1.63) that explains 40.87% total variance of the items. The scree test and the Horn's parallel analysis identified one factor with an eigen value of 1.63 which was above the 95th percentile of the values obtained in the random samples. The Cronbach's alpha was $\alpha=0.516$, with correlation between the items and the total corrected from $r=0.27$ (item 5.1) to $r=0.34$ (item 5.1) (Table-1).

A direct correlation and statistical significance was found, with medium effect size between the dimensions of somatization and the stressors ($r(152)=0.58$; $p<0.01$). The dimension of coping did not show significant correlations with any of the other measurements (Table-2).

For interpretative purposes, a score below the 25th percentile on any dimension was considered as a low level of AS, a value equal to or greater than the 25th

Table-2: Pearson correlation between the dimensions of SISCO inventory of academic stress.

	1	2	3	4
1.SISCO – Stressors	0.76 ^a			
2.SISCO – Somatization	0.58**	0.86 ^a		
3.SISCO – Coping	-0.09	-0.02	0.52 ^a	
4.Evaluation of global stress	0.45**	0.54**	-0.02	-

N = 152; ** p < 0.01;
^aReliability Coefficient Cronbach's alpha

percentile and under the 75th percentile as a medium level; and a score equal to or greater than the 75th percentile as a high level (Table-3).

Table-3: Summary statistics.

	Dimension of stressors	Dimension of somatization	Dimension Of coping
Descriptive statistics ^a			
Mathematic average	24.41	39.72	12.13
Standard deviation	5.04	9.16	2.57
Percentile 25	21	33	11
Percentile 50	24	40	12
Percentile 75	28	46	14
Asymmetry	0.066	0.170	-0.245
Kurtosis	-0.451	-0.237	0.035
Interpretation level			
Low	≤20	≤32	≤10
Medium	21-27	33-45	11-13
High	≥28	≥46	≥14

^aDescriptive statistics of the total scores of each dimension of SISCO inventory of academic stress in students of the School of Medicine, University of Concepcion.

Discussion

AS corresponds to a systemic response of the organism to adapt to the demands originating in an educational context. Research has shown AS in elementary students,¹⁷ and that increases as the students progress through educational levels.⁴

This study, the first of its kind in Chile, presents information on some of the psychometric properties of the SISCO-AS and its dimensions (as it refers to conceptually different variables), as well as information on its structure, and evidence of construct validity and reliability among college students pursuing health-related degrees in Concepcion, Chile.

The dimensions of stressors and somatisation presented a well-defined factor whereby all items reached significant loads. Furthermore, they had good reliability¹⁸ and items demonstrated adequate discriminative ability ($r > 0.30$) (Table-1).

The dimension of coping, presented challenges, as the EFA required elimination of two items successively, as significant factor loadings were not reached. Additionally, the resulting factor with the remaining four items showed questionable reliability.¹⁸ Although fewer items may explain the reduced reliability,¹⁵ the results contrasted with those reported in Colombian university students in a study which showed the dimension of coping as having good reliability (Cronbach's $\alpha = 0.7$).⁹

It is interesting that the differences between the Colombian and the Chilean populations are not only geographical, but also idiosyncratic and socio-cultural, as reflected in the items eliminated during the analysis process (religious practice and searching for information about their situation).

Most importantly, coping is a multidimensional construct, which is not a constituent part of AS, but an associated factor that enables moderation, and has been defined as "those constantly changing cognitive and behavioural efforts that develop to handle specific external or internal demands which are evaluated as excessive or overflowing the individual's resources".¹⁹ It is a dynamic process that involves continuous assessment by the individual strategies aimed to the "action" (actions to modify or alter the problem) and to the "emotion" (actions that help to regulate the emotional responses to the existing problem). This demonstrates that coping is a different construct and supports its exclusion by the second order factor analysis and the absence of correlation with the dimensions of stressors and somatisation.

Furthermore, coping, as a multidimensional construct, is difficult to adequately measure with four or six questions, and the existing instruments specific for coping, such as the inventory of coping strategies, has 40 items,²⁰ the coping scale for extreme risks has 36 items,²¹ and the coping strategies questionnaire has 42 items.²²

Thus, although the factor structure and reliability of the stressor and somatisation dimension are theoretically plausible and support the use of the SISCO-AS, we propose the possibility of dispensing with the dimension of coping, which will require further study.

The dimensions of stressors and somatisation demonstrated good reliabilities, but not that of coping. The overall reliability of the instrument, taking into consideration the dimension of coping, was very good,¹⁷ and was similar to that reported by studies.^{7-9,23}

However, it is important to consider that the second order EFA showed that the three dimensions of SISCO-AS contributed to a common measurement (Table-1), and that the high reliability observed of the instrument may be due to the effect of a greater number of items that artificially overestimate the Cronbach's coefficient.¹⁵

As was expected, the dimensions of stressors and somatisation show direct correlations with one another and correlate with the overall stress question of the SISCO-AS and thus coincide with the general appreciation of the subject.

Consequently, the dimensions of somatisation and stressors of SISCO-AS constitute instruments with evidence of validity

and reliability for their use in research and diagnostic approaches. However, their use as instruments for monitoring and determining AS requires more stringent psychometric standards.^{15,24} It is recommended that an overall score of this instrument should not be drawn. The use of coping dimension, for its unreliability and lack of relation with the question of global assessment of stress is discouraged. Instead, the use of specific tools is recommended to measure the variable coping.

To facilitate and define a cut-off point in this study, a ranking of the scores of the subjects was based on 25 and 75 percentiles. These percentile scales were proposed as only a reference, leaving it as a line of future research, the construction of scales in a broader and more heterogeneous sample.

This study has several limitations. First, the sample consisted primarily of female students (78.1%), limiting extrapolating to the university community. Second, the sample size, which did not allow the baremation nor allowed for a confirmatory factor analysis of the SISCO-AS. Third, the data comes from a self-reported type of instrument, which, although designed as such, has the potential for errors in the reporting or biased responses of the individuals.

Conclusion

The validity and reliability of the dimensions of stressors and somatisation of SISCO-AS was established, but not that of the coping dimension.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: Office of the Vice Rector of Research and Development, University of Concepcion and Research and Innovation Direction, Catholic University of the Most Holy Concepcion, Chile.

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