



Reliability and validity of the student stress inventory-stress manifestations questionnaire and its association with personal and academic factors in university students

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ABSTRACT

Background: Stress affects us in every environment and it is also present in the educational sphere. Previous studies have reported a high prevalence of stress in university students. The Student Stress Inventory-Stress Manifestations (SSI-SM), identify stressors and evaluate stress manifestations in adolescents but its validity in university students remains uncertain.

Objectives: We aimed to determine the internal consistency and validity of an adapted version of the Student Stress Inventory-Stress Manifestations (SSI-SM) for university students and to investigate if high stress levels are associated with personal and academic factors.

Design and Methods: In this quantitative, descriptive, cross-sectional study, we included 115 university students of the Nursing Degree during the second semester of the 2014/2015 academic year. Information about personal issues, lifestyle and academic performance was recorded and the stress was evaluated with the SSI-SM questionnaire. The internal consistency and homogeneity of the SSI-SM questionnaire was tested and a factorial analysis was performed.

Results: After the homogeneity analysis, the final version of the SSI-SM questionnaire included 19 items, with a Cronbach's alpha of 0.924. In the factorial analysis, 4 factors were found ('Self-concept', 'Sociability', 'Uncertainty' and 'Somatization'; all Cronbach's alpha > 0.700). Students with higher values on the SSI-SM were, in overall, women (41.0 ± 12.7 vs. 33.2 ± 9.5 ; $p = 0.001$) and had significantly more family conflicts (47.6 ± 13.8 vs. 35.2 ± 9.6 ; $p < 0.001$), consumed less alcohol ($R = -0.184$, $p = 0.048$), slept less hours ($R = -0.193$, $p = 0.038$) and had worse academic performance in Clinical Nursing (36.3 ± 10.4 vs. 41.2 ± 13.3 , $p = 0.039$).

Conclusions: After exclude three items of the original SSI-SM, higher scores in the SSI-SM are correlated with stress level in a cohort of university students of the Nursing Degree. Family conflicts, female gender, absence of alcohol consumption, few sleep hours and poor academic performance are associated with higher stress levels.

1. Background

Optimum stress is defined as the appropriate stress level required for a good mental and physical performance which allows being productive and creative. This is, indeed, a positive stress that could lead to a sense of confidence and control. These features are needed to carry out basic functions, to aim for objectives and to meet successfully the specific demands for the fulfillment of a difficult task (Naranjo-Pereira, 2009). Unfortunately, positive stress is not the only type of stress present in our society and it can be influenced by many internal and

external factors. Thus, an alteration of the optimal stress levels could negatively influence people because it exerts a direct action on their behavior and health. Indeed, stress plays an important role in the psychological and somatic disorders in adults but also in children and adolescents.

Since stress can affect us in every environment, it is also present in the educational sphere (Waqas et al., 2015). Thus, the university stage is potentially stressful and previous studies have reported a high prevalence of stress in university students, particularly during the exam period, when it could cause damage to their health and facilitate high

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dropout rates among students (Casas and Patiño, 2012). It is a period in which students often face different stressful situations and preoccupations such as the first contact with the university, the freedom of schedule organization, the selection of their university and degree, etc. (Saleh et al., 2017). By all these reasons, education professionals have focused on study and analyze the impact of stress and its relationship with student achievement (Berrío-García and Mazo-Zea, 2011), in order to provide students with appropriate techniques and/or therapies to minimize the negative outcomes produced by stress.

In 1989, Fimian et al. proposed the Student Stress Inventory - Stress Manifestations (SSI-SM) as a tool to identify stressors and to evaluate stress manifestations in adolescents (Fimian et al., 1989). However this questionnaire was only validated into school students, so its validity in university students is still uncertain. The aim of the present study was to determine, for the first time, the internal consistency and validity of an adapted version of the SSI-SM for university students and to investigate if a high stress level is associated with personal factors and worse academic results.

2. Designs and Methods

This is a quantitative, descriptive, cross-sectional study, involving 115 university students of the second year of the Nursing Degree at the Catholic University of Murcia (UCAM). All students were recruited during the second semester of the 2014/2015 academic year. Before enrollment, all participants were informed about the purpose of the study and signed the informed consent. The study protocol was approved by the Ethics Committee from the the Catholic University of Murcia (UCAM) and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Data was collected and processed anonymously and decline of participation was possible at any time without consequences.

2.1. Variables and Measurements

We recorded information about personal issues, lifestyle and academic performance in “Clinical Nursing”. This last variable was the grade obtained (pass or fail) in the subject “Clinical Nursing”, after the personal interview before the final exam. Information about stress was collected using the Student Stress Inventory - Stress Manifestations (SSI-SM) questionnaire (Fimian et al., 1989). This questionnaire included 22 items using a 5-point Likert-type score (from 1 = not at all, to 5 = completely) about emotional, physiological and behavioral areas. The maximum score was 110 points and higher scores indicate higher perceived stress.

2.2. Statistical Analyses

Categorical variables were expressed as frequencies and percentages. Continuous variables were presented as median and interquartile range (IQR), or mean \pm standard deviation (SD) if distribution was normal according to the Kolmogorov-Smirnov test.

In order to measure the internal consistency and homogeneity of the SSI-SM questionnaire, the Cronbach's alpha test was performed, accepting a coefficient ≥ 0.70 as an ideal value. The individual analysis of each item was carried out through the Homogeneity Index which was assessed with the Pearson correlation coefficient. Each item with a coefficient > 0.30 was considered useful for evaluating the attribute, and items not fulfilling this condition were excluded.

To analyze the underlying dimensions present in the test, a multivariate factor analysis was used. Prior to this analysis, suitability of the data was assessed by the Kaiser-Meyer-Olkin index. The contrast of the correlation matrix was verified with the Bartlett's sphericity test.

The factorial analysis was performed by exploring the main components in the correlation matrix of every questionnaire item, with orthogonal rotation using a Varimax rotation and the Kaiser criterion.

Only the factors with values higher than 1 were extracted, since these values could explain the higher percentage of the total variability using the following criteria: the extracted components have to be at least 60% of the detailed variance of the correlation matrix. To obtain consistent factorial weights, the criterion that an item must have values greater than or equal to 40 in order to be part of the extracted factor, was established.

To contrast differences in mean values of a quantitative variable (in a continuous scale of two independent populations), the Student's *t*-test was used, applying the appropriate value based on the existence of homogeneity or equality in the variance value as checked with the Levene statistic.

The association between categorical variables was performed using Pearson's chi-square test and correlation between continuous variables was assessed by the Pearson's correlation coefficient or the Spearman's rho, as appropriate.

A *p* value < 0.05 was accepted as statistically significant. Statistical analyses were performed using SPSS 16.0 for Windows (SPSS, Inc., Chicago, IL, USA).

3. Results

We included 115 Nursing students with mean age of 24.3 ± 6.2 year (72.4% women). The vast majority of students (87.9%) were single, while the rest of students were either married or living with a partner, and 61.2% of the sample lived in their families' home.

During the homogeneity analyses for each item, three items (3, 12 and 14) of the SSI-SM were excluded because the correlation coefficient was lower than 0.30. The final questionnaire contained 19 items with a range of possible values between 19 and 95 points. The average mean value was 38.90 ± 12.3 . After exclude the above cited items (i.e. 3, 12 and 14), we obtained a final model with a Cronbach's alpha of 0.924.

To test the validity and reliability of the questionnaire, a factorial analysis was performed which showed the presence of an underlying structure composed by four factors, according to the Kaiser-Meyer-Olkin's criteria. The sphericity test of Bartlett was also performed. The factors founded in the factorial analysis added up to 62.8% of the variance and every factorial-item had a value > 0.40 . The homogeneity tests for each of the four factors demonstrated a Cronbach's alpha value above 0.700, and none of them were removed due to a correlation coefficient lower than 0.300.

After Varimax rotation, Factor 1 included ten items related to ‘Self-concept’, Factor 2 included five items related to ‘Sociability’, Factor 3 incorporated six items measuring aspects that defined ‘Uncertainty’, and Factor 4 contained five items that analyzed the ‘Somatization’ (Table 1). Items included in Factor 1 (items 1, 4, 5, 6, 7, 8, 15, 16, 17 and 18) were related to the self-concept in personality that each student felt. This factor had a Cronbach's alpha of 0.922 (mean of 23.11 ± 8.21 points) and explained the 43.31% of the variance. Items of Factor 2 (items 11, 13, 16, 19 and 21) were related with the relationship with other students, friends and family, and had a Cronbach's alpha of 0.769 (mean of 8.24 ± 3.18 points), explaining the 7.49% of the variance. Regarding the items of Factor 3 (i.e. items 2, 4, 5, 8, 15 and 20), they were related with the ignorance and fear of a new situation and were associated with digestive disorders. This factor had a Cronbach's alpha of 0.846 (mean of 15.35 ± 4.96 points) and explained the 6.46% of the variance. Finally, as we described above, Factor 4 included items related with somatization (items 9, 10, 11, 17 and 22), i.e. physical manifestations of problems felt by students as a result of stressful situations and the perceived lack of university assistance. This factor had a Cronbach's alpha of 0.737 (mean of 7.90 ± 3.27 points) and explained the 5.59% of the variance.

Table 2 shows the association between personal problems and the four factors of the SSI-SM. The proportion of students suffering stress was higher in those with financial problems, couple relationship

Table 1
Factorial analysis of the Stress Questionnaire: rotated component matrix.

| Kaiser-Meyer-Olkin index | 0.896 | | | |
|---|--------------|-------------|-------------|--------------|
| Bartlett's sphericity test | < 0.001 | | | |
| Items | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
| | Self-concept | Sociability | Uncertainty | Somatization |
| 1. I feel irritated | 0.824 | | | |
| 2. Food disorders | | | 0.711 | |
| 4. I feel afraid | 0.524 | | 0.418 | |
| 5. I feel worried | 0.550 | | 0.642 | |
| 6. I feel anxious | 0.719 | | | |
| 7. I react defensively against others | 0.685 | | | |
| 8. I feel burdened | 0.633 | | 0.526 | |
| 9. I have cold sweats | | | | 0.680 |
| 10. I have itches all over my body | | | | 0.646 |
| 11. I feel unable to face university | | 0.439 | | 0.482 |
| 13. I disregard my social relations | | 0.718 | | |
| 15. I don't know what to do | 0.501 | | 0.477 | |
| 16. I have a negative attitude against others | 0.444 | 0.619 | | |
| 17. I have heart palpitations | 0.566 | | | 0.503 |
| 18. I feel angry | 0.615 | | | |
| 19. I discredit other people | | 0.621 | | |
| 20. I have a stomachache | | | 0.574 | |
| 21. I have difficulties interacting with others | | 0.786 | | |
| 22. I don't attend university because I am ill | | | | 0.691 |
| Self-values | 8.231 | 1.423 | 1.229 | 1.062 |
| Variance | 43.31% | 7.49% | 6.46% | 5.59% |

Table 2
Association between the Student Stress Inventory-Stress Manifestations questionnaire and personal issues, life habits and Clinical Nursing performance.

| | Factor 1 | | Factor 2 | | Factor 3 | | Factor 4 | | Total | |
|--|--------------|-----------|-------------|-----------|-------------|-----------|--------------|-----------|-------------|-----------|
| | Self-concept | | Sociability | | Uncertainty | | Somatization | | | |
| Family conflicts | | | | | | | | | | |
| Yes (n = 34) | 29.1 ± 8.8 | p < 0.001 | 10.0 ± 3.6 | p < 0.001 | 18.1 ± 5.0 | p < 0.001 | 9.9 ± 4.4 | p = 0.001 | 47.6 ± 13.8 | p < 0.001 |
| No (n = 81) | 20.5 ± 6.5 | | 7.4 ± 2.6 | | 14.1 ± 4.4 | | 6.9 ± 2.1 | | 35.2 ± 9.6 | |
| Couple relationship problems | | | | | | | | | | |
| Yes (n = 21) | 25.6 ± 8.7 | p = 0.115 | 9.1 ± 3.9 | p = 0.144 | 17.4 ± 5.1 | p = 0.027 | 8.9 ± 4.4 | p = 0.108 | 43.6 ± 14.8 | p = 0.051 |
| No (n = 94) | 22.5 ± 8.0 | | 8.0 ± 2.9 | | 14.8 ± 4.8 | | 7.6 ± 2.9 | | 37.8 ± 11.6 | |
| Financial problems | | | | | | | | | | |
| Yes (n = 30) | 25.0 ± 8.9 | p = 0.144 | 9.0 ± 3.7 | p = 0.103 | 16.5 ± 5.1 | p = 0.129 | 8.5 ± 4.0 | p = 0.170 | 42.2 ± 14.5 | p = 0.086 |
| No (n = 85) | 22.4 ± 7.8 | | 7.9 ± 2.9 | | 14.8 ± 4.8 | | 7.6 ± 2.9 | | 37.7 ± 11.4 | |
| Personal issues and life habits | | | | | | | | | | |
| Male sex (n = 32) | 18.8 ± 6.3 | p < 0.001 | 8.0 ± 3.4 | p = 0.616 | 12.9 ± 4.1 | p = 0.001 | 6.4 ± 1.7 | p < 0.001 | 33.2 ± 9.5 | p = 0.001 |
| Female sex (n = 83) | 24.7 ± 8.2 | | 8.3 ± 3.0 | | 16.2 ± 4.9 | | 8.4 ± 3.5 | | 41.0 ± 12.7 | |
| Marital status | | | | | | | | | | |
| Single (n = 101) | 23.5 ± 7.9 | p = 0.149 | 8.2 ± 3.0 | p = 0.816 | 15.7 ± 4.8 | p = 0.029 | 7.8 ± 2.9 | p = 0.616 | 39.3 ± 11.6 | p = 0.286 |
| Married (n = 14) | 20.1 ± 9.4 | | 8.4 ± 4.3 | | 12.6 ± 5.4 | | 8.2 ± 5.3 | | 35.5 ± 17.2 | |
| Residence | | | | | | | | | | |
| Familiar (n = 70) | 23.4 ± 9.1 | p = 0.550 | 8.4 ± 3.5 | p = 0.816 | 15.4 ± 5.3 | p = 0.882 | 8.2 ± 3.7 | p = 0.132 | 39.4 ± 13.7 | p = 0.531 |
| Others (n = 45) | 22.5 ± 6.5 | | 7.8 ± 2.4 | | 15.2 ± 4.4 | | 7.3 ± 2.2 | | 38.0 ± 10.0 | |
| Age | R = -0.176 | p = 0.060 | R = -0.037 | p = 0.696 | R = -0.226 | p = 0.015 | R = -0.011 | p = 0.905 | R = -0.139 | p = 0.137 |
| Smoking habit | | | | | | | | | | |
| Yes (n = 33) | 24.9 ± 9.1 | p = 0.124 | 8.7 ± 3.3 | p = 0.256 | 16.0 ± 5.5 | p = 0.327 | 9.2 ± 4.4 | p = 0.004 | 42.0 ± 14.9 | p = 0.085 |
| No (n = 82) | 22.3 ± 7.7 | | 8.0 ± 3.0 | | 15.0 ± 4.7 | | 7.3 ± 2.4 | | 37.6 ± 11.0 | |
| Physical exercise | | | | | | | | | | |
| Yes (n = 70) | 22.9 ± 7.6 | p = 0.819 | 8.0 ± 3.0 | p = 0.481 | 15.1 ± 4.3 | p = 0.113 | 7.3 ± 2.6 | p = 0.033 | 38.1 ± 11.1 | p = 0.446 |
| No (n = 45) | 23.3 ± 9.0 | | 8.5 ± 3.3 | | 15.7 ± 5.8 | | 8.7 ± 3.9 | | 40.0 ± 14.2 | |
| Stimulant drinks consumption | | | | | | | | | | |
| Coffee consumption | R = -0.009 | p = 0.925 | R = -0.042 | p = 0.656 | R = -0.033 | p = 0.500 | R = -0.015 | p = 0.876 | R = -0.045 | p = 0.631 |
| Alcohol consumption | R = -0.068 | p = 0.472 | R = -0.032 | p = 0.736 | R = -0.129 | p = 0.169 | R = -0.044 | p = 0.639 | R = -0.085 | p = 0.365 |
| Sleep hours | R = -0.174 | p = 0.062 | R = -0.132 | p = 0.158 | R = -0.177 | p = 0.057 | R = -0.137 | p = 0.143 | R = -0.184 | p = 0.048 |
| Clinical Nursing performance | | | | | | | | | | |
| Pass (n = 45) | 21.5 ± 7.67 | p = 0.064 | 7.7 ± 2.5 | p = 0.113 | 14.4 ± 5.0 | p = 0.065 | 7.0 ± 1.9 | p = 0.019 | 36.3 ± 10.4 | p = 0.039 |
| Fail (n = 67) | 24.5 ± 21.5 | | 8.7 ± 3.5 | | 16.1 ± 4.8 | | 8.5 ± 3.8 | | 41.2 ± 13.3 | |

problems and family conflicts. This proportion was significantly higher for family conflicts (47.6 ± 13.8 vs. 35.2 ± 9.6 ; $p < 0.001$) but not for financial problems which showed a trend to significance (42.2 ± 14.5 vs. 37.7 ± 11.4 , $p = 0.086$). Regarding couple relationship problems, we found a significant association with Factor 3 ‘Uncertainty’ (17.4 ± 5.1 vs. 14.8 ± 4.8 , $p = 0.027$) but only showed a trend to significance association with the total score (43.6 ± 14.8 vs. 37.8 ± 11.6 , $p = 0.051$).

In the analysis of personal traits and its relationship with the SSI-SM, we found a significantly higher proportion of women that suffered stress in comparison with men (41.0 ± 12.7 vs. 33.2 ± 9.5 ; $p = 0.001$). Neither the type of residence nor marital status or age, were associated with stress, except in the Factor 3 ‘Uncertainty’ for marital status and age, where single (15.7 vs. 12.6 , $p = 0.029$) and younger students ($R = -0.226$, $p = 0.015$) obtained higher scores.

Regarding to life habits, we observed a significant negative correlation between the amount of sleep hours slept the day before the survey was completed and the SSI-SM ($R = -0.193$, $p = 0.038$). Alcohol consumption was also negatively correlated with the questionnaire ($R = -0.184$, $p = 0.048$), but surprisingly not with its factors individually. Smoking habit and physical exercise only showed association with Factor 4 ‘Somatization’ (9.2 ± 4.4 vs. 7.3 ± 2.4 , $p = 0.004$ and 7.3 ± 2.6 vs. 8.7 ± 3.9 , $p = 0.033$; respectively) and no relationship was found between stress level and coffee consumption or stimulants (Table 2).

Finally, those students with low Clinical Nursing performance, i.e. who failed the final exam of Clinical Nursing, showed higher rates of stress in all factors and thus a significant higher score in the overall results of the questionnaire (36.3 ± 10.4 vs. 41.2 ± 13.3 , $p = 0.039$) (Table 2).

4. Discussion

The main finding of the present article is that, after exclude three items of the current SSI-SM in the homogeneity analyses, this tool is useful to identify stressors and stress manifestations in university students. Thus, in the final version of the SSI-SM, high scores are strongly correlated with stress level. Additionally, high stress levels were associated with family conflicts, female sex, few sleep hours and alcohol consumption in this cohort of University students. Stress was also related with worse academic results in these students.

The SSI-SM was proposed in order to identify physiological, emotional and behavioral manifestations of stress in adolescents (Fimian et al., 1989). In 2011, Escobar et al. adapted the SSI-SM to the Spanish context. Although this was undoubtedly an interesting first approach, they only validated the adapted SSI-SM version in adolescent students at the high school (Escobar Espejo et al., 2011). More recently, the SSI-SM has been validated in a large cohort, but again this study only included adolescents from the general population (with mean age of 14.61 ± 1.71 years) (Ortuño-Sierra et al., 2016).

University students, mainly during the first two years, are in a late adolescence period where stressors and their manifestations may be different in relation to an increase of their personal responsibilities (McSharry and Timmins, 2017). Indeed, university students often showed a high stress level compared to the general population (Cavallo et al., 2016), as well as low levels of self-esteem, optimism and self-efficacy (Saleh et al., 2017). In this line, a recent study including Germany medical students has also concluded that the level of perceived stress and emotional distress was higher than the age specific German general population (Heinen et al., 2017).

Given this information, stress seems to be a prevalent disease in university students of the Nursing Degree. The present study demonstrated that the SSI-SM is a useful tool that could help teachers and health professionals to identify the main variables affecting stress in this specific population. Therefore, this instrument is particularly interesting in Nursing students to early identify stress or to identify highly

stressful periods, which lead to implement interventions in order to decrease the stress.

Importantly, our results also revealed that students who reported personal problems (related to family, his/her partner or economic) scored higher on the SSI-SM, with statistically significant results shown for family conflicts, as was already reported by Balanza et al. in a study conducted in a university population (Balanza et al., 2008). Similarly, in the present study women had higher stress levels. This evidence has been previously described in many other studies (López and López, 2011; Saeed et al., 2016; Ticona et al., 2010), and maybe by this reason, female university students often report, compared to male, a higher use of strategies focused on emotions such as expression of feelings, finding of emotional support, denial, acceptance and positive reappraisal (Cabanach et al., 2011).

On the other hand, smoking habit and a sedentary lifestyle are behaviors usually started when stressed situations, so they can also increase the effects of negative stress. In fact, stress is a risk factor that has been associated with addictive behaviors (Carballo et al., 2011; Zvauya et al., 2017). However, our study only shows a significant association of smoking habit and sedentary lifestyle with the factor ‘somatization’, but not with the SSI-SM total score, while other authors like Alleyne et al. demonstrated an association between cigarette smoking and student stress level (Alleyne et al., 2012).

Regarding to alcohol, it is well known that its intake must not be used as a way to leave stress (Bressert, 2016; Keyes et al., 2012). However, in the present research alcohol consumption significantly reduces the total score of the SSI-SM. Although this could result surprising, and in fact it is, some studies have demonstrated that alcohol can reduce stress in certain people and under certain circumstances (Sayette, 1999). Nevertheless, from our point of view, alcohol abuse cannot in any way be integrated as an accepted stress-reducing tool. Thus, individualized interventions are necessary for those students suffering this phenomenon.

Additionally, in accordance with Alsagaaf et al., we identified a negative direct relationship between sleep hours and stress, i.e. students who slept less hours during the nighttime reported higher stress levels (Alsagaaf et al., 2016). This result was expected, since poor sleep quality and short sleep are associated with an overall worse health (Ohlmann and O’Sullivan, 2009).

Finally, we found that stress levels were higher for students with poorer academic performance in Clinical Nursing. In line with this, a study of Leppink et al. including 1805 students, demonstrated that severe perceived stress was associated with worse academic achievement and worse physical health (Leppink et al., 2016). Some authors have shown similar results, particularly in the first academic year when university brings changes and modifications to their lives, incorporating many stressful factors such as the lack of control over the new environment and the fear of failure in academic exams (Akgun and Ciarrochi, 2003; Felsten and Wilcox, 1992; Nieves et al., 2013; Wilkinson et al., 2016). Thus, the SSI-SM could also be useful for Nursing educators to relate low academic performances with high stress levels.

4.1. Limitations

There are some limitations that have to be addressed. First, this research included only students in their second year of Degree. We acknowledge that to include students of different years would enhance the generability of the study, and this is an issue that we will take in mind in the future. Second, this study was conducted only in Nursing students, so our results must be prospectively validated in University students from a larger variety of academic sectors. Similarly, this study was conducted in a single University, so more studies involving other Universities are also necessary.

5. Conclusions

After exclude three items of the original SSI-SM, this tool is useful to identify stressors and stress manifestations in a cohort of university students of the Nursing Degree. Thus, a high score in the SSI-SM is strongly correlated with stress level. Family conflicts, female gender, absence of alcohol consumption, few sleep hours and poor academic performance are associated with higher scores in the SSI-SM, and therefore with higher stress levels.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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