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Abstract

Introduction: An indisputable consequence has to do with the psychological impact of the COVID-19 pandemic on health professionals and students. In Cuba, these psychological manifestations have scarcely been investigated, and there are no reports in the dental undergraduate program. **Objective**: To analyze the evidence of validity and reliability of a scale of depression, anxiety and stress in Cuban dental students in the context of COVID-19. **Materials and Methods**: An instrumental and cross-sectional study was carried out, which included students of all years and Cuban universities. A documentary measurement instrument was validated, using its main psychometric evidence. Convergent validity was analyzed and reliability was estimated using Cronbach's alpha coefficient. **Results**: 301 students were included, of which 74.09% were women and whose ages ranged from 17 to

30 years. The asymmetry and kurtosis values of all items were adequate (> ± 1.5). The confirmatory factorial analysis showed that the factorial structure of 21 items distributed in 3 factors is satisfactory. The goodness of fit indices was satisfactory. The scale factors are directly and significantly related. With Cronbach's α coefficient, the scale scores were estimated to be reliable. **Conclusions**: the depression, anxiety and stress scale (DASS-21) in Cuban dental students in the context of COVID-19 turned out to be valid and reliable, in addition to allowing the evaluation of the dimensions of these three factors in this sector of the society.

Keywords: validation studies; anxiety; depression; stress; Dentistry students; mental health; COVID-19; SARS-CoV-2

1. Introduction

At the end of December 2019, a new coronavirus, initially named 2019nCoV and then SARS-CoV-2, which causes COVID-19, emerged in China.[1] The World Health Organization (WHO), in January 2020, reported the outbreak of the disease and already in March of that year declared it a pandemic.[2]

Beyond the medical risks, an indisputable consequence has to do with the psychological impact of the pandemic on health professionals[3,4] and students.[5-7] In the first group, because of their high exposure to the virus due to the work they perform on the front line, which has led them to experience stress, depression and anxiety.[8-10] In the second group, due to the social isolation that has generated changes in traditional education with repercussions in their classes and academic progress. Interestingly, the literature reports that they are also experiencing signs and symptoms of depression, anxiety and stress.[5-7]

In relation to these variables, stress is defined as the set of neuroendocrine, immunological, emotional and behavioral processes and responses which are triggered by situations that demand a greater than usual adaptation from the organism, and which are perceived as a threat or danger to biological or psychological integrity.[11] Depression is an affective disorder that is expressed through manifestations of sadness, frustration and changes in mood.[12] Likewise, anxiety is an emotional response whose function is activating and facilitating in order to have response capacity. It refers to physical and mental

manifestations which, unlike fear, which is a disturbance in the face of present stimuli, is more related to the anticipation of future, indefinable and unpredictable dangers.[13]

In this scenario, the current situation that dental students live makes them reflect on the importance for them to perform their pre-professional practices in contact with the patient, as part of the development of their professional profile; therefore, when they are unable to be confined, they can certainly develop psychological alterations, which if not controlled could generate major psychological disorders.[14] That is why the interest in studying the levels of depression, anxiety and stress in undergraduate dentistry is tied to the fact that it can affect their mental health and hinder the preparation of the student, which would directly affect their future job performance.

In light of the above, the scientific literature reports the existence of documentary measurement instruments to assess stress, anxiety and depression, especially one, which although conceptually considers that these variables are very different, asserts that in clinical practice and research they overlap.[15] Thus, the DASS-2[16] is an instrument made up of three self-report scales that measure the presence and intensity of affective states of depression, anxiety and stress; where each item is answered according to the intensity and presence of each symptom, taking into account the last week of life.[17,18]

This instrument is well known and used in Latin America; in fact, there is a Spanish version validated for Chilean university students,[15] Brazilian students,[19] Spanish university students and adults,[20,21] Colombian university students[22] and Peruvian students.[23] However, only a few Latin American studies have used the test in dental students, for example in Colombia[24] and Chile;[25] and at the international level in Romania,[26] Iran,[27] Australia[28] and Saudi Arabia.[30]

In Cuba, these psychological manifestations have scarcely been investigated, and there are no reports in the dental undergraduate program. It is worth noting that dental students are an important component and perform their work in dissimilar scenarios, both in direct attention to patients, in dental clinics or hospitals, places that constitute the teaching scenarios where they are formed through the practice acquired from on-the-job education. In order to approach this research topic, it is crucial to have scientifically validated instruments with the corresponding methodological rigor. Thus, the aim of the present

research was to analyze the evidence of validity and reliability of a depression, anxiety and stress scale in Cuban dental students in the context of the COVID-19 pandemic.

2. Material and Methods

2.1 Design

An instrumental and cross-sectional study was performed, since a documentary measurement instrument was validated by means of its main psychometric evidences.

2.2 Sampling and participants

Non-probabilistic snowball sampling, which included undergraduate students of both sexes, of all years and Cuban universities, who wished to participate and for which no exclusion criteria were established. A total of 301 students from 15 Cuban higher educational institutions participated, women (n = 223; 74.09%) and men (n = 78; 25.91%) whose ages ranged from 17 to 30 years of age (mean = 21.28 years [SD = 2.00]). The distribution by academic years is as follows: first (n=41; 13.62%) second (n=46; 15.28%), third (n=68; 22.59%), fourth (n=52; 17.28%) and fifth (n=94; 31.23%).

2.3 Instrument, procedures and data collection

The scale by Antony *et al*[18] was validated, which is an instrument composed of 21 items whose quantitative rating is made by means of a 4-point Likert scale ranging from 0 (it has not happened to me) to 3 (it has happened to me a lot). Due to the social isolation measures in force during the survey phase, the scale was available on the web for 25 days through the tools provided by the Google platform, specifically Google Forms. Through social networks such as Facebook, Telegram and WhatsApp, participants were invited to participate, they were told in the invitation message the objective of the research study and informed consent was requested before starting to answer the items. Voluntary and anonymous participation was considered.

2.4 Data analysis

First, the mean, standard deviation, skewness and kurtosis of the 21 items of the scale were calculated. The skewness and kurtosis coefficients did not show values above ± 1.5.[30]

Secondly, the internal structure of the DASS-21 was analyzed using the robust Diagonally Weighted Least Squares with Mean and Variance corrected (WLSMV) estimation. The recommendations of Keith[31] were considered, who indicates that the value of the comparative fit index (CFI) and the Tucker-Lewis Index (TLI) should report a minimum value of 0.90, the root mean square error of approximation (RMSEA) less than 0.08 and the standardized root mean square residual (SRMR) less than 0.06. Thirdly, convergent validity was analyzed and, finally, reliability was estimated using Cronbach's alpha coefficient. To analyze the descriptive statistics, convergent validity and reliability of the scale, the SPSS version 26 statistical software was used, and for the confirmatory factor analysis, the R program was used in its RStudio environment.

2.5 Ethical considerations

All aspects of the study were explained to the students before they participated. All information and personal data were anonymized. The considerations of the Declaration of Helsinki for research on human subjects were respected. The research project was not submitted for approval to a scientific board because at the time of its execution its sessions were suspended due to COVID-19 pandemic.

3. Results

3.1 Preliminary item analysis

Table 1 shows the calculation of the mean, standard deviation, skewness and kurtosis (descriptive statistics) of the twenty-one items of the DASS-21 scale. It is observed that item 13 has the highest mean score (M = 1.91) and item 21 shows the highest dispersion (SD = 1.20). The skewness and kurtosis values of all DASS-21 items are adequate as they do not exceed the range > ± 1.5.

3.2 Analysis of the internal structure of the scale

The confirmatory factorial analysis of the DASS-21 scale applied with Cuban dental students shows that the factorial structure of the 21 items distributed in 3 factors is satisfactory. The goodness-of-fit indices were satisfactory (CFI = 0.976, TLI = 0.973, RMSEA = 0.073, SRMR = 0.057 and WRMR = 1.099). The model met the goodness-of-fit criteria (Table 2).

3.3 Convergent validity

Table 3 shows that the DASS-21 scale factors are directly and significantly related to the GAD-2 ($p < 0.01$) and PHQ-2 ($p < 0.01$), thus the scale reports evidence of convergent validity.

3.4 Reliability

Reliability was estimated with Cronbach's α coefficient for the depression factor (α = 0.923; 95% CI = 0.90 - 0.93), for the anxiety factor (α = 0.866; 95% CI = 0.83- 0.89) and for the stress factor (α = 0.941; 95% CI = 0.92- 0.95); evidencing that the scale scores are reliable.

4. Discussion

The emotional repercussions due to symptoms of depression, anxiety and stress are an inseparable part of the life of a university student.[5,6,22] In this sense, students of medical sciences are particularly affected, since their study program differs from other university profiles, with a heavy course load that, by itself, generates certain emotional exhaustion that needs to be taken into account.[7]

Particularly in dental students, the educational repercussions of the COVI-19 pandemic have come to affect important aspects of their student life, mainly due to the suspension or reprogramming of their clinical and laboratory practices, which are indispensable for the development of basic skills. On the other hand, isolated from daily activities and forced to adhere to mandatory social isolation, the crisis generated by COVID-19 and its constant outbreaks created a climate of uncertainty which was detrimental to the mental health of students, and consequently to their university performance.[14,24-29]

Given this scenario, the need arose to study the psychological alterations resulting from the repercussions of the pandemic in higher education,[32] for which it is vital to have measurement instruments that demonstrate acceptable psychometric properties. Thus, the present study analyzed the evidence of validity and reliability of a depression, anxiety and stress scale in Cuban dental students in the context of COVID-19. It should be noted that the instrument in question, called the DASS-21 scale, has been used by a large number of

researchers due to its practical implications, since it is an instrument that is easy to understand and offers ease of self-assessment.[15,19-29]

Based on the results, the DASS-21 proved to be valid considering its internal structure, since the confirmatory factor analysis corroborated the original factor structure of 21 items distributed in 3 factors. These findings are similar to those found in other studies, such as *Antúnez et al*,[15] *Fundo et al*,[19] and *Contreras-Mendoza et al*,[23] showing satisfactory goodness-of-fit indices, with the model fulfilling the established criteria.

Given that the factors of the DASS-21 scale were directly and significantly related to the GAD-2 ($p < 0.01$) and the PHQ-2 (< 0.01), it was found that the scale reports evidence of convergent validity, coinciding in this sense with previous studies.[15,18,19,23]

Practical implications of these results can be evaluated in terms of recognizing that anxiety and stress are psychological disorders that are more prevalent during academic life, especially during college. Although the literature documents the existence of a type of positive stress (eustress) that puts the student in adaptive response mode, and, considering that anxiety is also an emotional reaction that activates the warning systems in situations of possible danger, overcoming this response capacity causes numerous problems in students such as: fear, irritability, moodiness, lack of motivation and depression, among others.[33] For this reason, having instruments capable of evaluating the dimensions of depression, anxiety and stress is of utmost importance to diagnose in time these unpleasant conditions in the student population of Cuban universities. In this way, it would be possible to generate strategies to prevent them or at least treat them in time, in order to achieve a higher academic level where students can be more fully focused on their studies.

The reliability of the instrument was estimated with Cronbach's α coefficient for all factors, showing that the scale scores are reliable. Because of the positive results it has shown, it is the most widely used coefficient to estimate reliability in applied research, due to its simple and reliable way to perform the construct validation of a scale and as a measure that quantifies the correlation between the items that compose it.[34]

This study has certain limitations. First, it was not feasible to obtain a random sample, since it was a voluntary study, which reduces external validity; however, the implementation of random sampling is recommended in future studies. Second, the collection of information was virtual, due to the context of the pandemic; this reduces control over the characteristics

of the participants, so it is recommended that in future studies an in-person evaluation be carried out, in order to contrast the results obtained. Third, the size of the sample did not allow for the implementation of other necessary procedures, such as invariance and item analysis from the Item Response Theory; its implementation is recommended in future studies.

5. Conclusion

The depression, anxiety and stress scale (DASS-21) proved to be valid and reliable in Cuban dental students in the context of COVID-19, in addition to allowing the evaluation of the dimensions of these three factors in this sector of society.

Consent for publication

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Declaration of competing interest

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Table 1. Preliminary analysis of the DASS-21 scale items.

Items	**M**	**SD**	**Skewness**	**Kurtosis**
1. Me ha costado mucho descargar la tensión☹	1.857	1.122	-0.424	-1.241
2. He notado la boca seca♣	1.047	1.087	0.453	-1.233
3. No he podido sentir ninguna emoción positiva☆	1.259	1.167	0.34	-1.361
4. He tenido dificultades para respirar (p.ej., respiración excesivamente rápida, falta de aliento sin haber hecho esfuerzo físico) ♣	0.92	1.082	0.744	-0.869
5. Me ha resultado difícil tener iniciativa para hacer las cosas☆	1.738	1.136	-0.305	-1.32
6. He tendido a reaccionar exageradamente ante las situaciones☹	1.502	1.105	-0.019	-1.323
7. He tenido temblores (p.ej., en las manos) ♣	0.831	1.118	0.967	-0.606
8. He sentido que estaba gastando una gran cantidad de energía☹	1.352	1.174	0.166	-1.46
9. He estado preocupado/a por situaciones en las que pudiera ser presa del pánico y hacer el ridículo♣	1.306	1.184	0.258	-1.443
10. He sentido que no había nada que me ilusionara☆	1.528	1.157	-0.069	-1.437
11. Me he sentido agitado/a☹	1.598	1.082	-0.096	-1.266
12. Me ha resultado difícil relajarme☹	1.831	1.085	-0.379	-1.184
13. Me he sentido desanimado/a y triste☆	1.917	1.067	-0.426	-1.174
14. No he tolerado nada que me impidiera seguir con lo que estaba haciendo☹	1.189	1.041	0.342	-1.096
15. He sentido que estaba al borde del pánico♣	1.047	1.180	0.579	-1.246
16. He sido incapaz de entusiasmarme por algo☆	1.322	1.120	0.208	-1.329
17. He sentido que no valía mucho como persona☆	1.047	1.189	0.6	-1.23
18. He tendido a sentirme enfadado/a con facilidad☹	1.767	1.102	-0.276	-1.286
19. He notado alteraciones en mi corazón sin hacer esfuerzo físico (p.ej., aumento del ritmo cardíaco, ausencia de algún latido♣	1.073	1.151	0.553	-1.194
20. Me he sentido asustado/a sin ninguna razón importante♣	1.256	1.143	0.29	-1.352
21. He sentido que la vida no tiene ningún sentido☆	1.04	1.203	0.613	-1.247

☆Dimension related with *depression*, ♣Dimension related with *anxiety* and ☹Dimension related with *stress*

Tabla 2. Fit indices for two evaluated models of the DASS-21 scale.

Model	χ^2	df	p	CFI	TLI	RMSEA		SRMR	WRMR
						Value	CI [90 %]		
21 items	484.463	186	<0.001	0.976	0.973	0.073	[0.065 - 0.081]	0.057	1.099

Note: df, degree of freedom; CFI, comparative fit index; TLI, Tucker-Lewis Index; RMSEA, Root mean squared error of approximation; CI, confidence interval.

Tabla 3. Means, standard deviations and correlations between the DASS-21, GAD-2 and PHQ-2 scales.

Variable	M	SD	1	2
1. GAD-2	2.63	1.85		
2. PHQ-2	2.71	1.85	0.70**	
3. DASS Depression	9.85	6.39	0.70**	0.82**
4. DASS Anxiety	7.48	6.33	0.75**	0.69**
5. DASS Stress	11.10	5.90	0.70**	0.69**

M = mean; SD= standard deviation, ** indicates p<0.01, GAD-2= Anxiety; PHQ-2= Depression.

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