

Original Article

Effect of breathing techniques and progressive muscle relaxation on medical students, Paraguay, year 2022

Efecto de técnicas de respiración y relajación muscular progresiva en Estudiantes de Medicina, Paraguay, año 2022

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ABSTRACT

Introduction: Stress, anxiety, and depression are neurological disorders with a high prevalence among university students. The most effective strategies for their management include progressive muscle relaxation and controlled breathing, among others. **Objective:** To determine the effect of breathing techniques and progressive muscle relaxation on stress, anxiety, and depression levels in medical students. **Methodology:** A quasi-experimental, prospective, longitudinal, cross-sectional, and explanatory study was conducted. Fifty-nine fourth-semester medical students participated, selected by non-probability convenience sampling. The DASS-21 test was used before and after applying diaphragmatic breathing and Jacobson's progressive muscle relaxation techniques, with a post-test. **Results:** The sample consisted primarily of young people aged 18 to 20 years (42.4%), mostly women (54.2%), Brazilian nationality (76.3%), and single (56.1%). Before the intervention, extremely severe, severe, and moderate levels of depression (6.8%, 15.3%, 59.3%), stress (8.5%, 13.6%, 33.9%), and anxiety (11.9%, 23.7%, 37.3%) were recorded. After the intervention, there was a significant reduction in all levels: depression (0%, 3.4%, 10.2%), stress (0%, 6.8%, 22%), and anxiety (0%, 8.5%, 28.8%), demonstrating the effectiveness of the techniques. **Conclusion:** Breathing and progressive muscle relaxation techniques are effective in reducing levels of depression, stress, and anxiety, improving the emotional well-being of students.

Keywords: Stress, Anxiety, Depression, Medical Students, Muscle Relaxation, Breathing Technique.

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RESUMEN

Introducción: El estrés, la ansiedad y la depresión son trastornos neurológicos con alta prevalencia en estudiantes universitarios. Las estrategias más efectivas para su manejo incluyen la relajación muscular progresiva, la respiración controlada, entre otras. **Objetivo:** Determinar el efecto de las técnicas de respiración y relajación muscular progresiva en los niveles de estrés, ansiedad y depresión en estudiantes de Medicina. **Metodología:** Se realizó un estudio cuasi experimental, prospectivo, de corte transversal. Participaron 59 estudiantes del cuarto semestre de Medicina, seleccionados por muestreo no probabilístico por conveniencia. Se utilizó la prueba DASS-21 antes y después de aplicar las técnicas de respiración diafragmática y relajación muscular progresiva de Jacobson, con un post-test posterior. **Resultados:** La muestra estuvo compuesta principalmente por jóvenes de 18 a 20 años (42,4%), en su mayoría mujeres (54,2%), de nacionalidad brasileña (76,3%) y estado civil soltero (56,1%). Antes de la intervención, se registraron niveles extremadamente severos, severos y moderados de depresión (6,8%, 15,3%, 59,3%), estrés (8,5%, 13,6%, 33,9%) y ansiedad (11,9%, 23,7%, 37,3%). Tras la intervención, hubo una reducción significativa en todos los niveles: depresión (0%, 3,4%, 10,2%), estrés (0%, 6,8%, 22%) y ansiedad (0%, 8,5%, 28,8%), demostrando la efectividad de las técnicas. **Conclusión:** Las técnicas de respiración y relajación muscular progresiva son efectivas para reducir los niveles de depresión, estrés y ansiedad, mejorando el bienestar emocional de los estudiantes.

Palabras clave: Estrés, Ansiedad, Depresión, Estudiantes de Medicina, Relajación muscular, Técnica de Respiración.

Introduction

The World Health Organization (WHO) estimates that 3.8% of the global population experiences depression, including 5% of adults. Worldwide, approximately 280 million people suffer from depression ⁽¹⁾.

Stress and anxiety are neurological disorders with a high prevalence among university students ^(2,3). Students in health-related fields constitute an even more vulnerable population for developing these disorders ⁽⁴⁻⁶⁾.

Recent studies have found significant prevalence rates of these disorders among medical students: 27.0% depression, 33.8% anxiety, and 49.9% stress. In addition, stress has been a subject of study and concern for behavioral scientists due to its impact on both physical and psychological health ⁽⁷⁾.

The transition from virtual classrooms back to face-to-face classes represents a stressor for all members of the educational community. The COVID-19 pandemic has left several lessons,

one of which is the importance of caring for mental health as a fundamental component of overall well-being ^(8,9).

Stress prevention and coping are essential for maintaining a healthy and satisfying lifestyle ⁽¹⁰⁾.

Stress and anxiety management tools are still underdeveloped in higher education institutions; however, in today's world, they have become almost indispensable to know ⁽¹¹⁾.

Several strategies exist for managing stress and anxiety. Those that have demonstrated greater effectiveness and ease of application in daily life include: (a) progressive muscle relaxation, (b) breathing control, and (c) thought control ⁽¹²⁻¹⁴⁾.

Providing these tools to health science students is of great importance, as they are exposed to high levels of stress and anxiety during their training due to the demands of their academic

curriculum. For this reason, this study aims to determine the effect of Progressive Muscle Relaxation Techniques on stress, anxiety, and depression levels among medical students in 2022, in order to subsequently adopt institutional measures that ensure student well-being.

Materials and Methods

A quasi experimental, prospective, cross-sectional study was conducted, focusing on medical students. This type of design is characterized by the absence of random assignment, instead resorting to a non-randomized design. The study population included fourth-semester students enrolled in the subject of Medical Psychology at a university in Paraguay during 2022. Inclusion criteria were: willingness to participate in the research, enrollment in the medical program, attendance of Medical Psychology in the fourth semester, and age 18 years or older. Exclusion criteria included a prior diagnosis of anxiety or stress made by a mental health professional or receiving treatment for any mental health disorder. Students who met the inclusion criteria signed informed consent.

Since quasi experimental designs often involve restrictions on randomization, non-probability convenience sampling was chosen, selecting all students in the aforementioned course who met the inclusion and exclusion criteria. A total of 59 students participated in the study. Data collection was carried out using a sociodemographic survey and the DASS-21 self-assessment test by Lovibond & Lovibond, which consists of 21 items divided into three categories: Depression, Anxiety, and Stress⁽¹⁵⁾. Responses were scored on a scale of 0 to 3, where 0 indicates that it did not occur and 3 indicates that it occurred very frequently.

Data were collected before and after the intervention, which consisted of weekly training sessions in Jacobson's progressive muscle relaxation techniques and diaphragmatic breathing, applied before classes and examinations over a 15-week period. Surveys

were administered using Google Forms and distributed via WhatsApp, ensuring that each submission was unique and could not be edited. The data collection period was from July to December 2022. Data were digitized and analyzed using SPSS software version 27, employing chi-square tests with a significance level of $p<0.05$.

Data confidentiality was guaranteed, ensuring that information would only be used for statistical purposes. The study, approved by the Ethics Committee of the María Auxiliadora University, was overseen by the UMAX Research and Innovation Department and the Ethics Committee. The main benefit of this study was to identify the levels of stress, anxiety, and depression among students and to evaluate the impact of stress and anxiety management techniques, with a view to their potential implementation throughout the university community.

A limitation of this study is that the use of a non-randomized design in the presented quasi-experimental study significantly influences the generalizability of the results. Selecting participants through non-probability convenience sampling limits the ability to extrapolate the findings to the general population of medical students, as the sample may not be representative of all student demographics or characteristics. Furthermore, non-random selection can introduce selection bias, where participants may have specific characteristics that predispose them to respond in a particular way to the intervention. Therefore, future studies could benefit from incorporating random selection methods and strategies to increase the representativeness and generalizability of the results to other populations.

Table 1. Sociodemographic Data.

| Sociodemographic Characteristics | Total (n=59) |
|----------------------------------|---|
| Sex (F:M) n % | 32 (54.2%): 27 (45.8%) |
| Marital Status % | Single: 39 (56.1%) Married: 10 (16.9%) Divorced: 0 (0%) Cohabiting: 10 (16.9%) Widowed: 0 (0%) |
| Student Age % | 18-20 years: 25 (42.4%) 21-25 years: 14 (23.7%) 26-30 years: 12 (20.3%) 31 years or older: 8 (13.6%) |
| Nationality % | Brazilian: 45 (76.3%) Paraguayan: 12 (20.3%) Argentine: 1 (1.7%) Angolan: 1 (1.7%) |

Source: Data obtained by the research team, year 2023.

Table 1 describes the sociodemographic data of the 59 students participating in the study.

The present study recorded the participation of 59 students of the 4th semester, of the subject Medical Psychology, of the Career of Medicine, of ages between 18 to 31 years or more, resulting in a prevalence of age between 18 to 20 years, (42.4%) corresponding to 25 students, female sex (54.2%) 32 students, Brazilian nationality (76.3%) 45 students and single marital status (76.3%) 39 students.

Table 2 shows the levels of depression, stress, and anxiety in medical students at the beginning and end of the second semester in 2022, before and after an intervention.

Comparing the depression, anxiety, and stress levels observed before the intervention with those obtained after the intervention

using Jacobson's progressive breathing and relaxation technique, it was concluded that the intervention was effective in reducing the levels of depression, stress, and anxiety in medical students at the end of the second semester of 2022.

Table 3 below presents the results of the comparison of mean depression, stress, and anxiety scores in medical students before and after the intervention, as well as the p-value indicating the statistical significance of the difference between the means.

The p-value results obtained for depression, anxiety, and stress indicated a statistically significant difference between the means and a significant reduction in depression levels after the intervention when comparing the values before and after the intervention.

Table 2. Levels of depression, stress and anxiety measured before and after an intervention.

| | | Before the intervention | | After the intervention | |
|--------------------------|-----------------------------|--------------------------------|-----------------------------|-------------------------------|------|
| Depression Levels | Absolute frequency | % | Absolute frequency | % | |
| Mild | 11 | 18,6 | 51 | | 86,4 |
| Moderate | 35 | 59,3 | 6 | | 10,2 |
| Severe | 9 | 15,3 | 2 | | 3,4 |
| Extremely severe | 4 | 6,8 | 0 | | 0 |
| Total | 59 | 100 | 59 | | 100 |
| Stress levels | Frecuencia. absoluta | % | Frecuencia. absoluta | % | |
| Mild | 26 | 44,1 | 42 | | 71,2 |
| Moderate | 20 | 33,9 | 13 | | 22 |
| Severe | 8 | 13,6 | 4 | | 6,8 |
| Extremely severe | 5 | 8,5 | 0 | | 0 |
| Total | 59 | 100 | 59 | | 100 |
| Anxiety levels | Frecuencia. absoluta | % | Frecuencia. absoluta | % | |
| Mild | 18 | 27,1 | 37 | | 62,7 |
| Moderate | 22 | 37,3 | 17 | | 28,8 |
| Severe | 14 | 23,7 | 5 | | 8,5 |
| Extremely severe | 7 | 11,9 | 0 | | 0 |
| Total | 59 | 100 | 59 | | 100 |

Source: Data obtained by the research team, 2023.

Table 3. Comparison of mean depression, stress, and anxiety levels in medical students before and after the intervention.

| Variables | Intervention | Media (DE*) | p-valor† |
|------------------|---------------------|--------------------|-----------------|
| Depression | Before (n=59) | 2,10 (0,781) | <0.0002 |
| | After (n=59) | 1,17 (0,41) | |
| Stress | Before (n=59) | 1,86 (0,955) | <0.0002 |
| | After (n=59) | 1,36 (0,609) | |
| Anxiety | Before (n=59) | 2,20 (0,979) | <0.0001 |
| | After (n=59) | 1,46 (0,659) | |
| Achievement | Before (n=59) | 28,41 (4,885) | <0.0002 |
| | After (n=59) | 16,58 (4,103) | |

*Standard deviation; † Wilcoxon test.

Source: Data obtained by the research team, 2023.

Regarding the achievements, it was concluded that the sample showed a reduction in the mean of the dependent variables: depression, stress, and anxiety, in the post-intervention period. It is worth noting that, prior to the intervention, the overall mean of the participants was above the midpoint of the construct, which is 28.41 points; after the intervention, it fell below this point. For the three variables under study, a

significance level (**p-valor†**) below 5% error was obtained, according to the Wilcoxon test.

Tables 4, 5, and 6 below present the results of the comparison of stress, anxiety, and depression levels in relation to the students' age, sex, marital status, and nationality:

Table 4. Relationship between age, sex, marital status, and nationality and depression.

| Depression | Mild | Moderate | Severe | Extremely Severe | Total n (59) | Chi-square test p-value |
|-----------------------|------|----------|--------|------------------|--------------|-------------------------|
| Age | | | | | | |
| 18-20 years | 19 | 5 | 1 | 0 | 25 | |
| 21 a 25 years | 13 | 1 | 0 | 0 | 14 | |
| 26 a 30 years | 11 | 0 | 1 | 0 | 12 | 0,343218 |
| 31 years or older | 8 | 0 | 0 | 0 | 8 | |
| Sex | | | | | | |
| Female | 28 | 3 | 1 | 0 | 32 | |
| Male | 23 | 3 | 1 | 0 | 37 | 0,967080 |
| Nationality | | | | | | |
| Brazilian | 38 | 5 | 2 | 0 | 45 | |
| Paraguayan | 11 | 1 | 0 | 0 | 12 | |
| Argentine | 1 | 0 | 0 | 0 | 1 | 0,985390 |
| Angolan | 1 | 0 | 0 | 0 | 1 | |
| Marital Status | | | | | | |
| Single | 33 | 4 | 2 | 0 | 39 | |
| Cohabiting | 8 | 2 | 0 | 0 | 10 | 0,513878 |
| Married | 10 | 0 | 0 | 0 | 10 | |

Source: Data obtained by the research team, year 2023.

Table 5. Relationship between age, sex, marital status and nationality between stress.

| Stress | Mild | Moderate | Severe | Extremely Severe | Total n (59) | Chi-square test p-value |
|-----------------------|------|----------|--------|------------------|--------------|-------------------------|
| Age | | | | | | |
| 18-20 years | 17 | 7 | 1 | 0 | 25 | |
| 21 a 25 years | 9 | 2 | 3 | 0 | 14 | |
| 26 a 30 years | 9 | 3 | 0 | 0 | 12 | 0,261841 |
| 31 years or older | 7 | 2 | 0 | 0 | 8 | |
| Sex | | | | | | |
| Female | 24 | 8 | 0 | 0 | 32 | |
| Male | 18 | 5 | 4 | 0 | 27 | 0,075668 |
| Nationality | | | | | | |
| Brazilian | 33 | 9 | 3 | 0 | 45 | |
| Paraguayan | 8 | 3 | 1 | 0 | 12 | |
| Argentine | 1 | 0 | 0 | 0 | 1 | 0,651958 |
| Angolan | 0 | 1 | 0 | 0 | 1 | |
| Marital Status | | | | | | |
| Single | 24 | 11 | 4 | 0 | 39 | |
| Cohabiting | 9 | 1 | 0 | 0 | 10 | 0,235868 |
| Married | 9 | 1 | 0 | 0 | 10 | |

Source: Data obtained by the research team, 2023.

Table 6. Relationship between age, sex, marital status, and nationality and anxiety.

| Anxiety | Mild | Moderate | Severe | Extremely Severe | Total n (59) | Chi-square test p-value |
|-----------------------|------|----------|--------|------------------|--------------|-------------------------|
| Age | | | | | | |
| 18-20 years | 16 | 7 | 2 | 0 | 25 | |
| 21 a 25 years | 11 | 2 | 1 | 0 | 14 | 0,783175 |
| 26 a 30 years | 6 | 5 | 1 | 0 | 12 | |
| 31 years or older | 4 | 3 | 1 | 0 | 8 | |
| Sex | | | | | | |
| Female | 19 | 11 | 2 | 0 | 32 | |
| Male | 18 | 6 | 3 | 0 | 27 | 0,526475 |
| Nationality | | | | | | |
| Brazilian | 28 | 12 | 5 | 0 | 45 | |
| Paraguayan | 9 | 3 | 0 | 0 | 12 | |
| Argentine | 0 | 1 | 0 | 0 | 1 | 0,344543 |
| Angolan | 0 | 1 | 0 | 0 | 1 | |
| Marital Status | | | | | | |
| Single | 28 | 9 | 2 | 0 | 39 | |
| Cohabiting | 5 | 3 | 2 | 0 | 10 | 0,221740 |
| Married | 4 | 5 | 1 | 0 | 10 | |

Fuente: Datos obtenidos mediante el equipo investigador, año 2023

No significant differences were observed between depression, stress, and anxiety and the variables: age, sex, nationality, and marital status. The chi-square test applied to the three tests yielded a significance level greater than 0.05.

Discussion

This study evaluated 59 medical students and measured their levels of depression, stress, and anxiety before and after the application of Jacobson's progressive muscle relaxation and breathing technique. The results indicate that the intervention is effective in reducing depression, stress, and anxiety levels and improving academic performance in medical students. These findings are consistent with results of the research by Sandoval et al. (7), which establishes the prevalence of these disorders in the medical student population. Furthermore, Tamayo (2019), Iglesias et al. (2018), and Robles-Mendoza, A.L. and López-Sánchez, O. (2022) affirm in their research the

effectiveness of progressive muscle relaxation and diaphragmatic breathing techniques as coping mechanisms for reducing these disorders (12-14).

Similarly, these results align with research conducted by Nogueira Pires in Brazil in 2022, who identified that after a two-month intervention involving relaxation exercises, the overall quality of life score was significantly improved in the experimental group. She concluded that relaxation techniques can be effective in improving the quality of life and reducing anxiety among medical students (16). Likewise, research conducted by Guevara Vásquez in a Peruvian population in 2020, using a pre- and post-test, confirmed that the application of teaching strategies, including relaxation and progressive relaxation techniques, was effective in significantly reducing anxiety levels in subjects before exams. Providing students with teaching strategies increases their self-confidence and emotional management skills in relation to performance in academic assessment processes (17).

Additionally, in the research carried out by Borja Cedeño et al., in Ecuador, it was found that medical students present academic overload composed of tasks, exams and activities of the educational field with a limitation in time to deliver them, which generates high levels of academic stress and suicidal ideation, therefore, based on these results, they proposed the implementation of psychological intervention strategies for the adequate coping of them, with the Schultz autogenic training relaxation technique being one of the most positive results, so that students can achieve a state of relaxation through exercises and thus experience a better quality of life ⁽¹⁸⁾.

On the other hand, this study did not observe significant differences between depression, stress, and anxiety in the variables of age, sex, nationality, and marital status. This finding does not coincide with that described by Gutiérrez Pastor in Spain, who states that factors such as being female, diet, and substance use have been significantly associated with clinical patterns of anxiety and depression in medical students ⁽¹⁹⁾.

Furthermore, referring to Ordóñez Galeano in Guatemala, the act of entering university already generates experiences of anxiety. In many cases, university students come from different backgrounds and present socioeconomic and personality differences, which could influence depression, stress, and anxiety. It was observed that the majority of students were between 16 and 20 years old, and the predominant sex was female, certainly coinciding with the age and gender prevalence of the present study ⁽²⁰⁾.

Finally, as described by Velastegui Hernández in Ecuador 2021, it is noteworthy that, although anxiety and depressive symptoms are frequent among medical students, this fact has been corroborated in university populations during the COVID-19 pandemic, revealing the unequivocal impact it has had on the mental health of university students. It was also found that anxiety is a much more recurrent condition than depression in the analyzed sample ⁽²¹⁾.

This aligns with the present research, as evidenced by the severe and extremely severe levels of anxiety and depression obtained in the sample. Therefore, it should be noted that, according to the research conducted, there is a high prevalence of mental health disorders among medical students, and the intervention with breathing techniques and progressive muscle relaxation is effective in reducing levels of depression, stress, and anxiety, thus producing a positive effect on the students.

Authors' contributions: Arami Ortellado González, conception and design of the study, data collection and acquisition of results. Olga Sosa Aquino, analysis and interpretation of results. Luciana Daniela Garlisi Torales, conception and design of the study. José Nicolás Ayala Servín, critical review of the manuscript and approval of its final version. Leia Maria Brändao, Mirna Gabriela Bogado Segovia, Jessica Cipriano de Almeida, literature review and data coding.

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