2026, Vol. 6, No. 2, 62–73
https://doi.org/10.47602/johah.v6i2.153

Enhancing Positive Health through Progressive Muscle Relaxation: A Mixed-Methods Study among University Students

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University students constitute a vulnerable population regarding mental health challenges, a situation often exacerbated by systemic stressors during global crises. This mixed-methods study investigates the efficacy of Progressive Muscle Relaxation (PMR) as a proactive positive health intervention to enhance self-regulation and psychological well-being during the COVID-19 pandemic. Conducted in accordance with institutional ethical standards and based on voluntary participation, this study utilized a quasi-experimental pretest-posttest design with 100 university students. During the initial lockdown, psychological distress was measured via the Depression, Anxiety, and Stress Scale (DASS-21), alongside the collection of written accounts to capture participants' subjective experiences. Quantitative analysis using Repeated Measures MANOVA revealed a statistically significant reduction in psychological distress with a large effect size following at least seven days of PMR practice. Complementing these results, thematic analysis elucidated that PMR fosters positive health through dual pathways: psychological relief via emotional and cognitive regulation and physical restoration through improved sleep quality and somatic relaxation. Crucially, the qualitative findings identified specific cues of action related to the timing, consistency, and progressive structure of the exercise, which served as vital moderators for subjective well-being. The findings suggest a strong congruence between quantitative symptom reduction and qualitative pathways to resilience, concluding that PMR is an accessible self-regulation strategy that promotes sustainable psychological growth and positive health in university settings.

Keywords. positive health, progressive muscle relaxation (PMR), psychological resilience, self-regulation, stress management, university students

Challenging life experiences fundamentally alter an individual's connection with both their internal self and their external environment, subsequently leading to various physical, psychological, and social difficulties (Arslan, 2016; Lazarus & Folkman, 1984). The recent COVID-19 pandemic represented an unprecedented global impact, rapidly evolving into a significant stressor due to the intense uncertainty and unpredictability it introduced, particularly in its early stages. This high-stress environment necessitated effective stress management and proactive self-regulation strategies across the entire population to maintain subjective well-being (Arslan, 2022). In an attempt to control the virus, widespread closures were implemented, which struck the educational setting with particular force. This situation adversely affected university students, a demographic that is inherently vulnerable to stressful life events due to their transitional developmental stage (Farris et al., 2021). This vulnerability was further compounded by the multidimensional barriers introduced by the pandemic, creating a critical need for targeted health promotion.

Barriers to Positive Health: The Multidimensional Impact of Distress

Various systemic stressors, including escalating concerns about future career prospects, intensified academic stress, and sudden difficulty accessing basic needs, contributed to this burden. Furthermore, the mandatory restriction of daily activities and the challenges in reaching traditional social support networks increased the risk for mental health struggles. These factors significantly contributed to many students exhibiting intense psychological symptoms (Di Consiglio et al., 2021; Ferrara et al., 2022). What began as an acute, time-limited event eventually evolved into a state of chronic stress, demanding heightened self-regulation capabilities to foster psychological resilience. Research highlights that the levels of psychological distress increased sharply among university students, especially during the early phases of the pandemic, creating a pervasive sense of instability (Farris et al., 2021; Milia et al., 2021). This distress was frequently linked to heightened clinical indicators of depression, anxiety, and stress, emphasizing the need for interventions that promote positive health outcomes even in times of crisis.

Depression is a highly prevalent psychological disorder. As Debowska et al. (2022) and Hamaideh et al. (2022) observed during the COVID-19 pandemic, prevalence rates among university students reached significant levels, with some studies reporting that nearly 25% to 30% of students exhibited moderate to severe depressive symptoms. It significantly impacts an individual's capacity for subjective happiness, encompassing persistent negative emotions such as sadness, guilt, and a pervasive loss of desire.

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Beyond emotional distress, it manifests through physical symptoms like psychomotor changes and disturbances in sleep, alongside cognitive changes such as impaired focus and attention (American Psychiatric Association [APA], 2022).

Anxiety represents another critical dimension of psychological distress, characterized by heightened negative affect, physical tension, and apprehensive negative future expectations that hinder an individual's ability to remain present (APA, 2022). During the COVID-19 pandemic, anxiety levels among university students surged as the academic environment became synonymous with unpredictability and isolation. Studies indicate that anxiety not only co-occurs frequently with depression but also acts as a primary catalyst for academic burnout and diminished subjective well-being (Debowska et al., 2022; Hamaideh et al., 2022). Therefore, addressing anxiety proactively is a fundamental component of fostering positive health.

Stress, which is central to this discussion and the primary target of relaxation interventions, is considered a multi-component process where an individual's relationship with their environment is disrupted by a perceived threat (Lazarus & Folkman, 1984). In stressful situations, individuals typically exhibit intertwined physical (e.g., tension, difficulty breathing), cognitive (e.g., negative thoughts, concentration problems), emotional (e.g., anger, depression, anxiety), and behavioral responses. These multidimensional reactions are particularly common among university students who face unique developmental pressures (Promsri, 2019).

To comprehensively assess this interconnected triad of psychological distress—depression, anxiety, and stress—the Depression, Anxiety, and Stress Scale (DASS) has been widely recognized in the literature as a robust psychometric tool (Lovibond & Lovibond, 1995; Yıldırım et al., 2018). Utilizing such multidimensional tools in the literature allows researchers to capture the nuanced effects of systemic crises on student well-being beyond mere descriptive statistics, providing a critical synthesis of how these variables interact.

The significant rise in students' depression, anxiety, and stress levels during the initial COVID-19 lockdowns underscored the urgent demand for effective psychological support that goes beyond traditional clinical settings (Hamaideh et al., 2022). Moreover, the likelihood of these symptoms progressing to more severe psychological and physical disorders if left unmanaged highlights a critical point for health promotion. Rather than waiting for symptoms to reach a clinical threshold, there is a necessity for proactive interventions focused on self-regulation and the active cultivation of health. By empowering university students with self-applied tools, we can mitigate the risk of long-term impairment and support their trajectory toward sustainable psychological well-being (Debowska et al., 2022).

Progressive Muscle Relaxation

A diverse array of interventions can be implemented to enhance self-regulation and mitigate symptoms in university students, ranging from structured psychotherapy to self-administered techniques like meditation, breathing exercises, and Progressive Muscle Relaxation (PMR) (Yusufov et al., 2019). Within the framework of positive health promotion, PMR is considered to be a highly prevalent and advantageous method for regulating anxiety, depression, and stress (Muhammad Khir et al., 2024; Varvogli & Darviri, 2012). It is particularly favored by both practitioners and participants because it is reported to have no significant side effects, is easily understood across various literacy levels, and remains highly accessible. Furthermore, the fact that PMR can be self-administered and is cost-effective makes it a sustainable resource for enhancing subjective well-being (Gangadharan & Madani, 2018; Muhammad Khir et al., 2024; Varvogli & Darviri, 2012). In the context of large-scale crises like the COVID-19 pandemic—where traditional, face-to-face clinical access is often severely limited—PMR's accessibility and its ability to build self-efficacy become particularly valuable. By providing students with a tangible tool they can use independently, PMR can empower them to take an active role in their own mental health journey. This positions PMR not just as a clinical intervention, but as an accesible, scalable tool for large-scale stress management and the cultivation of psychological resilience in high-pressure environments.

PMR, pioneered by Edmund Jacobson in the 1920s, remains a cornerstone relaxation technique in both clinical and health-promotion settings (Jacobson, 1938). The practice requires individuals to actively focus their attention on a systematic cycle of tensing and subsequently releasing specific muscle groups. This intentional focus on the shift from tension to relaxation facilitates self-regulation by engaging higher brain regions while transmitting proprioceptive stimulation from peripheral muscles to the central nervous system (Keptner et al., 2021). Physically, the exercise induces a potent parasympathetic effect, fostering a state of tranquility evidenced by measurable decreases in blood pressure, respiration rate, and heart rate (Davison et al., 2005). Thus, PMR serves as a valuable and accessible method for achieving psychophysiological well-being through the change of internal states.

Extensive research with individuals facing chronic health challenges further underscores the functional benefits of PMR in managing systemic stress. In oncological settings, PMR has been documented to significantly reduce fatigue while simultaneously increasing coping skills and overall quality of life (Gök-Metin et al., 2019; Pradhan et al., 2020). Beyond mitigating distress, it is effective in alleviating somatic burdens like chemotherapy-induced nausea (Kim & Seo, 2010). Its utility extends to cardiac care, where it decreases anxiety and depression in coronary heart disease patients (Chaudhuri et al., 2020), and to geriatric health (Ghodela et l., 2019). PMR's scope also encompasses physical relief, effectively reducing chronic pain (Heravi-Karimavi et al., 2004) and enhancing sleep quality in patients with respiratory conditions (Chegeni et al., 2018). Consequently, PMR is recognized as a well-established non-pharmacological strategy for the holistic management of somatic complaints and the promotion of positive health (Gill et al., 2004).

The efficacy of PMR in fostering psychological resilience among university students is well-supported by consistent evidence of reduced stress and anxiety (Heravi-Karimavi et al., 2004; Mailloux, 2006; Toussaint et al., 2021). This is particularly vital in health-related education, where elevated academic and clinical pressures are prevalent. Studies in nursing students have demonstrated significant reductions in test-related and pre-clinical

anxiety (İnangil et al., 2020; Jyothimol & Lobo, 2020; Korkut et al., 2021; Toqan et al., 2022; Zargarzadeh & Shirazi, 2014). Furthermore, its positive impact on younger adolescent populations establishes PMR as a versatile tool for enhancing the well-being of young adults across various educational contexts (Kabakcıoğlu & Ayaz-Alkaya, 2024).

During the COVID-19 pandemic, the adaptability of relaxation exercises was further proven through successful remote delivery models. Online mindfulness and physical interventions were highlighted for their ability to support student mental health during lockdowns (Harrison et al. 2024). Specific PMR interventions during this period demonstrated significant effectiveness for anxiety and sleep disturbances among COVID-19 patients, frontline healthcare workers, and infected students (Liu et al., 2020; Zhang et al., 2021; Vaishnav & Vajpai, 2020; Supriatin et al., 2022).

Despite this robust quantitative foundation, qualitative explorations into the subjective experience of PMR remain scarce. Initial qualitative work suggests that PMR empowers individuals by helping them manage negative emotions and regain control over their cognitive and behavioral processes (Bahadır-Yılmaz & Yüksel, 2024; Nair et al., 2024; Fischer et al., 2022). Finally, a review of PMR's implementation reveals its remarkable flexibility, with effective durations ranging from single sessions to three-week practices (Dolbier & Rush, 2012; Kim & Seo, 2010; Ghodela et al., 2019; Gök Metin et al., 2019). The consensus that just 4-5 consecutive sessions can produce meaningful change underscores PMR's role as a brief, self-paced, and highly practical intervention for fostering long-term health and resilience (Zargarzadeh & Shirazi, 2014).

Theoretical and Conceptual Framework

This study is theoretically grounded in the Transactional Model of Stress and Coping proposed by Lazarus and Folkman (1984), which posits that stress arises when an individual perceives environmental demands as exceeding their adaptive resources. Within this theoretical framework, the COVID-19 pandemic serves as a severe environmental stressor, while PMR is introduced as a proactive, emotion-focused coping strategy designed to replenish the individual's self-regulation resources.

Conceptually, the study is structured to clearly distinguish between the intervention and its targeted outcomes. The independent variable is the structured PMR intervention (applied over a minimum of seven days). The dependent variables are the specific multidimensional psychological outcomes—depression, anxiety, and stress levels—operationalized and measured via the DASS-21. By explicitly applying this framework, the present study moves beyond describing psychopathology; it synthesizes evidence-based literature to test how a targeted behavioral intervention directly alters the subjective stress-appraisal relationship, clearly distinguishing empirical findings from author interpretations.

Present Study

A review of the current literature indicates that university students faced an amplified psychological risk during the pandemic, yet PMR offered multi-faceted positive contributions through enhanced self-regulation (Farris et al., 2021; Liu et al., 2020; Vaishnav & Vajpai, 2020). While existing research extensively confirms PMR's quantitative efficacy across various clinical populations, there remains a notable gap in understanding the subjective experience and the specific underlying mechanisms that translate this technique into improved subjective well-being. This gap is particularly evident in the context of large-scale social crises, where individual responses to stress are deeply personal and multi-faceted (Nair et al., 2024).

To address these limitations and provide a more holistic view of positive health, the primary aim of this study is to investigate the efficacy of PMR in mitigating depression, stress, and anxiety levels among university students within the unique socio-psychological landscape of the COVID-19 pandemic. A mixed-methods design was strategically employed, incorporating both quantitative data from self-report inventories and qualitative data derived from participants' written experiences. This approach is chosen because it does not merely provide a numerical assessment of symptom reduction; more critically, it utilizes qualitative inquiry to explore the "how" and "why" behind the data.

By integrating participants' narratives with their quantitative results, this research highlights how PMR helps students develop resilience and self-regulation skills in high-pressure situations. It is anticipated that teaching students a relaxation exercise to manage pandemic-induced distress will have a positive impact on their healthy coping skills and overall well-being. Ultimately, by integrating these two methodologies, this study aims to reveal the transformative potential of PMR in fostering a sense of agency and positive health autonomy, providing a deeper, more nuanced understanding of its role as an accessible and effective coping mechanism during times of global instability.

In line with these objectives, the following hypotheses were tested for the quantitative phase of the study:

Hypothesis 1 (H1): Seven days of consistent PMR practice will lead to a statistically significant reduction in depression scores among university students.

Hypothesis 2 (H2): Seven days of consistent PMR practice will lead to a statistically significant reduction in anxiety scores among university students.

Hypothesis 3 (H3): Seven days of consistent PMR practice will lead to a statistically significant reduction in stress scores among university students.

Furthermore, the qualitative phase was guided by the following research questions:

Research Question 1 (RQ1): How do university students subjectively experience the psychological and physical effects of PMR during a global crisis?

Research Question 2 (RQ2): What are the specific contextual factors and mechanisms that influence the perceived effectiveness of the relaxation practice?

Method

The present study employed an explanatory sequential mixed-methods design to investigate the efficacy of PMR. In this design, the quantitative data (DASS-21 scores) served as the primary assessment of symptom reduction, while subsequent qualitative data (written reflections) were collected to explain and provide deeper

contextual insights into the quantitative results.

Participants

The sample consisted of 100 undergraduate students recruited via convenience sampling from the psychology department of a foundation university in Istanbul, Türkiye. Three participants were excluded from the final analysis because they failed to complete the post-test scales or provided incomplete daily exercise logs. Consequently, analyses were conducted on 97 participants (84.5% women, n=82; 15.5% men, n=15). The participants' ages ranged from 20 to 28 years, with a mean age of 21.74 (SD = 1.11). The majority of the participants were single (97.9%), and a significant proportion identified their socioeconomic status as upper-middle (92.8%). Regarding their academic level, all participants were enrolled in undergraduate psychology programs. While the vast majority were following the lockdown orders at home in various urban localities, one participant (n=1) was an essential healthcare worker pursuing a second degree.

Data Collection Instruments

Demographic Information Form. Following informed consent, participants were presented with a demographic information form prepared by the researcher. To capture this data, the form used a mixed-response format: participants reported their age with an open-ended numerical response, whereas gender, socioeconomic level, and marital status were assessed with multiple-choice questions in which participants selected the most appropriate categorical option from predefined lists.

Depression, Anxiety, and Stress Scale-21 (DASS-21). The Depression, Anxiety, and Stress Scale, developed by Lovibond and Lovibond (1995), was used to determine participants' levels of depression, anxiety, and stress. The scale consists of 21 items divided into three subscales (depression, anxiety, and stress), each containing seven items. Higher scores on the subscales, which are frequently used in the literature, indicate increased severity of the related symptom. Participants completed the instrument by marking how often they experienced specific symptoms over the past week on a 4-point Likert scale: 0 (did not apply to me at all), 1 (applied to me to some degree, or some of the time), 2 (applied to me to a considerable degree, or a good part of time), and 3 (applied to me very much, or most of the time). The Turkish adaptation of the scale was conducted by Yıldırım, Boysan, and Kefeli (2018). In the present study, the Cronbach's Alpha internal consistency reliability coefficients indicated good to excellent internal consistency, calculated as .89 for the Depression subscale, .87 for the Anxiety subscale, and .90 for the Stress subscale.

Progressive Muscle Relaxation (PMR) Exercise. The PMR exercise utilized in this study was adapted from Jacobson (1927), using the Turkish translation by Güliz Elal Lawrence (Sertel-Berk, 2020). The exercise content begins with a brief instruction, followed by sequentially tensing 16 muscle groups, starting with the hand muscles, for 5 seconds and then relaxing them for 10 seconds. The PMR exercise was digitally transmitted to participants as an audio file, with calming classical music in the background. The audio file could be accessed via a QR code provided in the Sertel-Berk (2020) source. Based on previous findings in the literature, participants were advised to practice the exercise individually for at least 20 minutes, at least once a day, for at least 1 week. The consensus that just 4-5 consecutive sessions can produce meaningful change underscores PMR's role as a brief, self-paced, and highly accessible intervention for fostering long-term health and resilience (Zargarzadeh & Shirazi, 2014). Building on this evidence, the decision to use a 7-day continuous administration in the present study was strategically determined. Given the acute and rapidly evolving stress of the early pandemic lockdowns, a one-week intervention was deemed optimal: it is sufficiently long to surpass the minimum threshold required to establish a psychological relaxation response, yet brief enough to maintain high participant adherence and prevent attrition during a period of global crisis (Dolbier & Rush, 2012). Researchers ensured accessibility throughout the study by providing participants with the option to reach them via online messages or email for any questions or issues regarding the exercise or the research process.

Procedure

Ethical approval for the study was obtained from the university's ethics committee (Decision No: 20292139-050.01.04 Date: 2020/08 - Application submitted March 2020; formal approval delayed due to pandemic lockdowns). Additionally, permission for the research was secured from the Ministry of Health (Application No: 2020-08-17T13_57_09). The study was announced to the students, and the informed consent form, demographic information form, DASS-21, the PMR audio file, and a Word document for participants to record their exercise experiences were shared via the university's online system. Data collection took place between April 1–10, 2020, coinciding with the beginning of the first weekend lockdowns in Türkiye.

The instructions given to the participants were as follows: "Please complete the informed consent form, the demographic information form, and the DASS-21 shared with you. Then, practice the progressive muscle relaxation exercise provided as an audio file every day (for at least 7 days). After your final application of the exercise, refill the DASS-21 scale. Finally, share your experience regarding how this exercise affected you in writing. Please upload the completed scales and the Word document to the system." The qualitative data were collected using a single, broad, open-ended narrative prompt designed to encourage unstructured reflection. Participants were asked the following: 'Finally, share your experience regarding how this exercise affected you in writing.' This approach was chosen to allow participants to report their subjective experiences (psychological, physical, or contextual) without being constrained by specific researcher-led categories, thereby ensuring the emergence of organic themes during the thematic analysis. To monitor intervention adherence, participants were provided with a structured daily log within a Word document. They were required to record the completion of each PMR session, noting the date and duration. This log served as a qualitative verification of their consistency; consequently, only participants who demonstrated full compliance by submitting a complete seven-day record were retained in the final sample.

Written informed consent was shared with all participants, ensuring the principle of voluntary participation and explicitly stating their right to withdraw from the study at any time without any penalty. To ensure strict confidentiality and data security, all collected data were immediately anonymized using participant codes

(e.g., P1, P2) and stored on a password-protected, encrypted local drive accessible only to the researcher. Furthermore, in accordance with institutional data retention policies, all digital records will be retained for a duration of five years following publication, after which they will be securely and permanently deleted from all storage devices.

Data Analysis

Quantitative data were analyzed using SPSS 25. Prior to hypothesis testing, underlying assumptions for multivariate analysis were examined. The data met the assumptions of normality, and the homogeneity of variance-covariance matrices was confirmed. To evaluate the effect of time (pretest–posttest) on participants' depression, anxiety, and stress levels, a repeated-measures MANOVA was employed. Although the study assesses changes across two time points, this rigorous multivariate approach was specifically chosen over multiple paired-samples t-tests or univariate repeated measures ANOVAs. Because the three dependent variables measured by the DASS-21 are theoretically and statistically highly intercorrelated, analyzing them simultaneously within a single MANOVA model controls for family-wise Type I error inflation and accurately captures the overarching effect of the intervention on the participants' multidimensional psychological state.

The qualitative data (written accounts) were collected from all 97 participants who completed the quantitative scales. No sub-sampling was used for the qualitative phase; every participant provided a written reflection of their experience as part of the post-test procedure. For the analysis of qualitative findings, each participant's response was analyzed using thematic analysis with a codebook in Excel. This approach incorporated the interpretive depth of reflective thematic analysis while ensuring coding reliability. To ensure participant anonymity, each participant was coded as P1 or P2, and their responses were recorded accordingly. The thematic analysis was conducted according to the steps outlined by Braun and Clarke (2006). Initially, the researcher familiarized themselves with the data by recording and repeatedly reading the participants' responses and taking detailed notes. Subsequently, salient features were identified in the data set, and preliminary coding was performed. These codes were grouped under potential themes, reviewed for clarity and consistency, and examined by an independent researcher. Participants' quotes were then transferred to a table and manually highlighted with different colors corresponding to thematic categories, thereby creating a color key (Bree & Gallagher, 2016; Meyer & Avery, 2009). Items with matching colors were grouped for deeper thematic analysis. Finally, the coding consistency was checked, suitable themes were determined for these codes, and the codes were systematically placed under the relevant sub-themes. This final version was reviewed by a different observer to obtain expert opinion. Note-taking was performed throughout the process, and these notes were used to appropriately develop and categorize the emerging codes and themes.

Within the explanatory sequential mixed-methods framework, data integration occurred at the interpretation phase. Specifically, the initial quantitative findings regarding the reduction in DASS-21 scores guided the subsequent qualitative analysis. The thematic findings derived from participant narratives were systematically mapped onto the statistical outcomes to unpack and contextualize the specific mechanisms driving the numerical decrease in psychological distress.

Results

Quantitative Results

The data met the assumptions of normality, and participants' pretest and posttest scores on the Depression, Anxiety and Stress Scale (DASS-21) are presented in Table 1. As detailed in the table, the magnitude of change was substantial across all dimensions; mean depression scores dropped from 17.11 to 11.05, anxiety from 15.02 to 8.98, and stress from 18.41 to 11.66, indicating a robust reduction in self-reported symptoms following the intervention.

Table 1. Mean and standard deviation scores of participants on the depression, anxiety, and stress scale before and after the PMR exercise

	N	Mean	SD
Pre-test Depression	97	17.11	8.11
Post-test Depression	97	11.05	6.84
Pre-test Anxiety	97	15.02	8.77
Post-test Anxiety	97	8.98	5.88
Pre-test Stress	97	18.41	7.68
Post-test Stress	97	11.66	7.02

Repeated Measures MANOVA was conducted to examine the effect of time (pretest–posttest) on participants' depression, anxiety, and stress levels. As presented in Table 2, the results indicated that the main effect of time was statistically significant (Wilks' λ Lambda = .408, $F(1, 96)=139.08$, $p<.001$, $\eta^2=.592$). Significant reductions were observed in all three variables following the intervention. The effect size ($\eta^2=.592$) corresponds to a "large" effect according to Cohen's (1988) criteria (small=.01, medium=.06, large=.14).

The main effect of the scale factor was also significant ($F(2, 95)=11.19$, $p<.001$, $\eta^2=.191$), indicating mean-level differences among the three subscales (depression, anxiety, stress). The scale × time interaction was not significant ($F(2, 95)=1.21$, $p=.304$, $\eta^2=.025$), suggesting that the intervention exerted a similar pattern of change across all variables. Overall, the findings indicate that a structured, seven-day practice of PMR was followed by statistically significant reductions in depression, anxiety, and stress levels among participants. These results suggest that even a brief, self-administered intervention suggests a potential to disrupt the cycle of self-reported psychological distress within this specific sample.

Qualitative Results

The quantitative results demonstrated that PMR had a significant positive effect on depression, anxiety, and stress levels, suggesting a measurable shift toward psychological well-being. The qualitative data further revealed the nuances of participants' subjective experiences of these changes, moving beyond numerical reductions to identify the mechanisms of health. The thematic analysis conducted on participants' written reflections showed that their experiences of the progressive muscle relaxation exercise were organized around three main themes: psychological effects, physical effects, and cues of action. These overarching themes and their associated subthemes—derived from participant statements and coded systematically—are presented in Figure 1. Collectively, these

themes illustrate that PMR not only alleviates distress but also facilitates a holistic sense of self-regulation and somatic awareness.

Table 2. Repeated measures MANOVA results for participants' depression, anxiety, and stress scores before and after the PMR intervention

Effect	Wilks' λ	F	df	P	η^2
Scale	-	11.19	2, 95	<.001	.191
Time (prepost)	.408	139.08	1, 96	<.001	.592
Scale X Time	-	1.21	2, 95	.304	.025

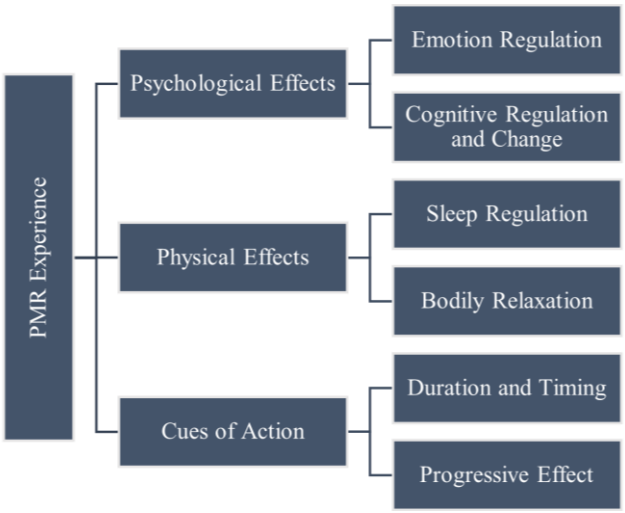

Figure 1. Main themes and subthemes derived from participants' statements on their experiences with the progressive muscle relaxation exercise

Psychological Effects

The psychological effects theme captures participants' detailed statements indicating that the PMR exercise effectively regulated stress, anxiety, and depressive emotions, while also facilitating significant cognitive regulation and change. Most participants reported feeling more relaxed, calm, happy, peaceful, and in control after completing the exercise, suggesting a shift toward subjective well-being. In terms of emotional regulation, they noted clear reductions in stress and tension as well as improvements in overall mood. One participant described this experience as follows, *"Doing this exercise really relaxed me, and I can say that I feel less stressed than I did a week ago, which was also reflected in my test results''* (P56).

Another participant expressed the effect by stating, *"I felt calmer*" (P3), while another emphasized mood improvement with, *"I feel happier''* (P80). As illustrated by the statement *"The relaxation exercise helps me manage my stress and anxiety''* (P69), some participants reported using the exercise as an effective coping strategy for emotional regulation.

A second dimension of the psychological effects theme involved cognitive regulation and change, which is a key component of self-regulation. Participants stated that they were able to distance themselves from anxious and negative thoughts, think more positively, and experience mental relaxation and clarity. This cognitive shift is vital for positive health, as it allows individuals to regain focus. One participant explained, *"I especially practiced the exercise before studying, and I noticed that I could focus better on what I was reading and that my attention improved''* (P83).

Some participants described this effect as a sense of mental clarity, while others highlighted improvements in attention and concentration, which in turn increased their motivation and academic engagement. For example, one participant stated, "*My mind felt clearer, and I was able to distance myself from anxiety-provoking thoughts''* (P32), whereas another noted the effect on coping with negative thoughts: *"I realized that the exercise helped me cope with my negative thoughts''* (P1). Another participant emphasized that the exercise enhanced motivation and helped shift attention toward controllable aspects of life: "*With the exercise, my willingness to take action increased, and I focused on the things I can control; my anxiety decreased''* (P74).

These statements collectively indicate that PMR contributed to both emotional and cognitive regulation, playing a significant role in reducing stress, anxiety, and depressive symptoms. Overall, participants appeared to use the relaxation exercise not just as a temporary relief, but as an effective, self-administered coping method for managing these complex psychological difficulties and enhancing their psychological resilience.

Physical Effects

Another prominent theme identified in the qualitative analysis concerns the physical effects of PMR, which serve as a fundamental factor for positive health. Nearly all participants reported experiencing bodily relaxation and a significant sense of physical relief following the exercise. Among these effects, improved sleep quality was one of the most frequently mentioned outcomes, highlighting the restorative nature of the intervention. Participants indicated that practicing the exercise at night helped them fall asleep more easily, feel more rested, and wake up feeling refreshed. One participant described this restorative benefit as; *"I can say that it also improved my sleep quality; I noticed that I fell asleep more easily and woke up feeling more refreshed, and I think doing the exercise before bedtime played a role in this''* (P49).

Participant statements further revealed that PMR's most noticeable impact was on the physical body, specifically through increased bodily awareness, the recognition of latent tension, and meaningful reductions in pain or tightness—particularly in the back, shoulders, and neck. Furthermore, participants noted decreases in fatigue, trembling, shortness of breath, and general exhaustion. One participant explained how the exercise facilitated a parasympathetic effect through regulated breathing and muscular release: "*Feeling my muscles relax and breathing regularly was good for my body; I felt my anxiety decrease and my heart rate slow down, and I began to fall asleep more easily''* (P53).

Another participant emphasized the increased somatic awareness gained through the exercise, expressing that it helped them recognize the physiological manifestations of stress and anxiety that often go unnoticed:

> "I realized that this process had a much greater impact on me than I was aware of. I noticed a significant amount of tension in my body. Even when I tried to let it go, my body resisted. This affected me a lot because I was able to experience firsthand how

much stress and anxiety can operate in the background without us consciously realizing it" (P56).

Many participants reported significant reductions in pain-related complaints, which directly contributes to their overall subjective well-being. As illustrated in the statements, *"It helped significantly reduce my bodily pain and tension''* (P28) and "*After the stretching movements for my arms, shoulders, and neck, I felt relaxation in my tense muscles''* (P45), this effect was most frequently observed in the shoulder and neck areas, which are common somatic storage sites for academic and pandemic-related stress. These findings suggest that PMR promotes positive health by helping students re-establish a healthy connection with their bodies and fostering physical resilience.

Cues of Action

The Cues of Action theme captures how participants experienced the impact of PMR across timing, consistency, environmental conditions, and individual awareness. Participant narratives indicated that the effects of the exercise generally emerged gradually and became more pronounced—both psychologically and physiologically—with regular practice.

Many participants reported that they benefited more when performing the exercise in the evening, when their stress levels tended to peak. One participant described how the exercise helped them cope with the specific anxiety triggered by pandemic-related news:

"During the first two days, I practiced the exercises during the day, but I did not notice any difference. Starting from the following five days, I began doing them after coming home from work. Since the Ministry of Health briefings were given in the evening, my stress levels were usually higher at that time, so the exercise was more effective when practiced in the evening" (P39).

Several participants reported that the exercise became noticeably more effective after the third session. The following quote illustrates how a participant began to "settle into the flow" of the exercise and even gained awareness of their behavioral habits:

"The first three days were a bit difficult because my mind could not stay in the moment. I kept worrying about the future and felt the urge to check my phone. So, the first three sessions weren't very productive. But after the third day, I was able to let myself go with the flow and allow my body to relax. Realizing my screen addiction and being able to control it made me feel even better" (P42).

Another participant similarly noted an incremental reduction in stress after several days of practice:

"I didn't notice any change during the first two days. The effects began on the third day. My stress decreased right after the exercise, though it would eventually return. The real improvement happened on the fourth day and beyond. Thanks to the previous sessions, I started feeling more relaxed throughout the day, and even before starting the exercise, my stress levels were lower. My stress decreased noticeably compared to the first day" (P15).

One participant highlighted the cumulative nature of the exercise's effects across psychological and physical domains; "*I practiced the exercises regularly for seven days. By the end, I noticed that my muscle pain gradually diminished, my negative thoughts and feelings decreased, and I could complete my daily tasks and routines without difficulty''* (P59).

These accounts demonstrate that PMR functions as a rhythmic learning process with effects that accumulate over time. Participants emphasized that the exercise does not merely offer momentary relief; rather, when practiced consistently—particularly during peak stress periods and in a supportive environment—it becomes a sustainable tool for self-regulation. These qualitative codes are consistent with the quantitative findings, confirming that PMR effectively supports emotional and cognitive regulation while producing noticeable physical relaxation.

To reinforce the explanatory sequential mixed-methods approach, the thematic qualitative findings were explicitly mapped onto the numerical reductions observed in the DASS-21 scores. The statistically significant decrease in the Depression subscale aligns directly with the qualitative reports of improved mood, increased motivation, and the regaining of cognitive focus (captured under the Psychological Effects theme). Similarly, the robust reduction in Anxiety and Stress scores is vividly illustrated by participants' subjective experiences of diminished physical tension, slower heart rates, and improved sleep quality (categorized under the Physical Effects theme). Ultimately, the qualitative narratives explain the precise mechanisms behind the quantitative data, revealing that the numerical drop in DASS-21 scores is a direct reflection of participants successfully regaining psychophysiological self-regulation.

Discussion

The COVID-19 pandemic multi-dimensionally affected university students, a population already identified as being at significant risk for psychological symptoms due to their transitional developmental stage. Experiences related to cognitive, emotional, and physical distress—particularly symptoms of stress, anxiety, and depression—were markedly intensified as a result of global lockdowns and the prolonged uncertainty that defined the early stages of the crisis (Di Consiglio et al., 2021; Ergüney Okumuş, 2025; Hamaideh et al., 2022). Within this challenging landscape, this study, conducted with 100 volunteer university students during the initial phase of the pandemic, utilized both quantitative and qualitative methods to investigate the efficacy of PMR as a tool for fostering psychological resilience.

The quantitative findings indicate that DASS-21 scores for depression, anxiety, and stress significantly decreased with a large effect size following the consistent practice of PMR for a minimum of seven days. Consistent with previous research, these findings suggest that PMR application during a period characterized by high stress and systemic uncertainty resulted in a significant reduction in self-reported scores for distress. When situated within the broader literature, the results strongly parallel the findings of Kabakcıoğlu and Ayaz-Alkaya (2024) and Toqan et al. (2022), who observed similarly robust reductions in pre-clinical anxiety and stress among nursing and adolescent student populations facing academic pressures. Furthermore, the magnitude of the decrease in depression scores in our study aligns with the recent systematic review by Muhammad Khir et al. (2024), reinforcing the efficacy of PMR as a

non-pharmacological intervention for mood regulation in young adults. From a positive health perspective, this reduction in scores suggests that PMR is associated with a mechanism that may help students support their subjective well-being by lowering the self-reported barriers created by the pandemic. The alignment between these statistically significant reductions and the participants' subjective narratives provides a more nuanced understanding of how PMR serves as a mechanism for positive health and emotional restoration.

While these results are robust, certain methodological limitations regarding the study design and participant characteristics should be considered; these are discussed in detail in the Limitations and Future Directions section. To understand how the observed positive changes in the research variables occurred and to capture the subjective experience of health, a qualitative assessment was undertaken using participants' narratives. This qualitative component serves as a key contribution of this mixed-methods approach, providing contextual depth to the quantitative findings.

The Role of PMR on Psychological and Somatic Health

The qualitative component of this research analyzed participants' written experiences through thematic analysis and revealed that PMR experiences converged around three main themes: Psychological Effects, Physical Effects, and Cues of Action. Regarding the Psychological Effects, the practice specifically pointed to a positive influence on emotional regulation, as evidenced by participants' accounts of feeling calmer, more serene, peaceful, and relaxed, alongside a reduction in anxiety, stress, and depressive feelings. Furthermore, statements regarding positive thinking, mental clarity, and increased attention and motivation suggest that the exercise played a significant role in cognitive regulation. While methodologically similar studies are limited, comparable findings highlighting PMR's ability to enhance attention and contribute to the management of emotions and cognitions are notable in the literature. The observed reduction in anxiety and depression scores is reflected in participants' descriptions of enhanced emotional stability, such as P32, who noted that a clearer mind allowed for a distancing from anxiety-provoking thoughts, thereby grounding the numerical data in lived experience. For instance, Bahadır-Yılmaz and Yüksel (2024) similarly reported that participants found PMR helpful in managing negative emotions and stress while experiencing increased academic performance. Effects such as improved attention levels and gaining control over cognitive, emotional, and behavioral processes—similar to the codes and themes found here—have also been reported in prior work such as that by Nair et al. (2024).

Regarding the Physical Effects of PMR, nearly all participants reported experiencing bodily relaxation, decreases in tension and pain, and increased body awareness. Participants particularly highlighted a notable positive change in sleep problems, which are commonly observed during the pandemic context. In this framework, PMR application was observed to positively influence not only psychological well-being but also the active promotion of physical health, aligning with the results emphasized by previous studies in the literature such as Chegeni et al. (2018) and Gill et al. (2004). Participants' specific reports of improved sleep quality and reduced muscle tension (e.g., P49, P53) further elucidate the physical pathways through which the significant decrease in overall stress scores was achieved. Qualitative studies have also reported PMR as functional in coping with physical symptoms, especially pain, and increasing bodily awareness (Bahadır-Yılmaz & Yüksel, 2024; Nair et al., 2024). Furthermore, Fischer et al.'s (2022) research showed that related practices like yoga and physical exercise were similarly functional, particularly in the effective management of pain.

Understanding the Cues of Action

The final prominent theme identified through qualitative findings encompasses the strategic Cues of Action associated with PMR practice. Participant narratives highlighted that the efficacy of the exercise was intrinsically linked to its timing and frequency, with a majority reporting a greater subjective benefit when the application was performed during evening hours—periods when perceived stress typically reached its peak. This finding that participants gained more from the practice during high-stress moments aligns with the observations of Dolbier and Rush (2012) and research by Peyee et al. (2021), both of which emphasized that the impact of PMR is more pronounced in individuals experiencing elevated stress levels. In the specific context of this study, evening practice provided a targeted coping mechanism against the acute anxiety triggered by the daily announcement of COVID-19 case numbers, which occurred each evening during the early stages of the pandemic.

Furthermore, participants emphasized a clear learning curve, noting that the exercise became significantly more effective as the frequency of practice increased over time. This gradual progression supports the foundational principle established by Jacobson (1943) that relaxation is a skill to be learned progressively. Narrative accounts revealed that while the first few sessions often involved challenges such as cognitive distractions or difficulty "staying in the moment," consistent engagement allowed participants to eventually "settle into the flow" and achieve deeper states of physical and mental relaxation. The digital availability of the exercise, facilitating easy usage via headphones at self-selected times, further supported this gradual development of self-regulation.

Beyond simple outcome measures, the qualitative data on 'Cues of Action' highlights that the effectiveness of PMR is not static but contingent upon timing and consistency, explaining why some participants noted more pronounced improvements as the seven-day period progressed. When assessed together, the quantitative and qualitative findings of this study suggest that PMR functions as a multi-dimensional coping method with cumulative effects that accumulate across both psychological and physical domains. By the end of the seven-day intervention, participants not only reported significant reductions in depression, anxiety, and stress scores but also described a newfound ability to manage negative thoughts, alleviate muscle pain, and maintain daily routines with greater ease. Ultimately, observing these transformative effects during a global period marked by extreme uncertainty contributes significantly to the growing body of research regarding the populations and crisis conditions for which PMR is most effective (Muhammad Khir et al., 2024).

Limitations and Future Directions

While this study offers significant contributions to understanding the role of PMR during a global crisis, several methodological limitations must be acknowledged and interpreted

cautiously regarding their impact on the findings. A primary constraint involves the study design and measurement methods. The utilization of a single-group pretest-posttest design without a randomized control group presents a significant threat to internal validity. In the volatile context of the early COVID-19 lockdowns, the observed symptom reduction might have been influenced by time, natural adjustment to the situation, or history effects rather than the PMR intervention alone. Furthermore, the reliance on self-report inventories (DASS-21) and self-reported daily logs for adherence introduces social desirability bias. This risk is exacerbated by the fact that all participants were psychology students; their pre-existing knowledge of mental health constructs may have led to an overestimation of the intervention's efficacy, potentially inflating the magnitude of the reported outcomes. To mitigate these biases and isolate the specific efficacy of PMR, future research must employ randomized controlled trials (RCTs) and integrate objective physiological markers (e.g., cortisol levels) or digital tracking to independently verify practice frequency.

Another critical limitation involves the intervention delivery itself. The PMR audio guidance included background classical music. Because music independently possesses stress-reducing properties, it serves as a confounding variable, making it difficult to firmly isolate whether the magnitude of the observed improvements is solely attributable to the muscle relaxation technique. Future studies should aim to use standardized audio instructions without background music to more precisely evaluate PMR's isolated efficacy.

Furthermore, the study's demographic composition presents a significant limitation to external validity. The sample was highly homogeneous, consisting predominantly of female participants (84.5%) from upper-middle-class backgrounds (92.8%). This specific and relatively privileged demographic profile means the findings may primarily reflect female experiences of PMR and may not be generalizable to individuals from diverse socioeconomic backgrounds or gender identities who faced different structural challenges during the pandemic. Future research must utilize stratified sampling and targeted recruitment strategies to include male perspectives and more diverse populations, particularly those from lower socioeconomic strata.

Finally, the age of the data must be explicitly acknowledged. As the data were collected during the immediate peak of the COVID-19 lockdowns in early 2020, the findings reflect a specific historical and psychological context. This may impact the current relevance of the results, as long-term societal adjustment to the pandemic has since altered the general psychological landscape. Future research in more stable contexts should incorporate longitudinal designs to validate these findings and determine the long-term trajectory of PMR's benefits. Despite these limitations, the study underscores PMR's potential as a flexible, remote-accessible tool for positive health promotion when traditional support systems are disrupted.

Conclusion

The comprehensive results of this research suggest that even a brief, one-week intervention of PMR may serve as a potentially effective resource for university students in reducing their depression, stress, and anxiety levels while navigating periods of intense environmental pressure. The somatic impact of the practice, particularly regarding the mitigation of sleep disturbances, emerged as an important factor for many individuals, reinforcing the potential role of PMR as a functional tool for positive health. Consistent with established literature, these findings provide preliminary support for the clinical and preventive use of PMR as a means to restore psychophysiological equilibrium.

In the context of institutional health promotion, PMR application offers potential advantages for university student health services because it does not require a high level of specialized therapeutic skill and can be explored in cost-effective group or digital formats. Its high efficiency and low-cost nature, as noted by Dolbier and Rush (2012), make it a promising option to consider for broader interventions. Furthermore, the ease with which PMR can be integrated into existing structured clinical frameworks allows for more versatile support units within academic settings (Ergüney-Okumuş et al., 2019).

Previous studies have highlighted the effectiveness of PMR as a preventive practice for high-risk groups like university students (Ergüney-Okumuş, 2024; Muhammad Khir et al., 2024; Varvogli & Darviri, 2012). Therefore, exploring the incorporation of PMR applications into university curricula—particularly within high-stress fields such as medicine, nursing, and psychology— represents a promising avenue for future research. Pending further validation through randomized controlled trials, such educational integration could potentially enhance students' coping repertoires, contributing to long-term positive effects on holistic health and the maintenance of subjective well-being across the lifespan.

Compliance with Ethical Standards

Disclosure of Potential Conflicts of Interest. The authors declare no conflicts of interest related to the research, authorship, and/or publication of this article.

Funding. The author has received no financial support for the research, authorship, and/or publication of this article.

Ethical Approval. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments, or comparable ethical standards. The ethical approval for this research was obtained from the Istanbul Sabahattin Zaim University Ethics Committee (Date: 2020/08, Decision No: 20292139-050.01.04). Additionally, research permission was granted by the Ministry of Health of the Republic of Turkey with application number 2020-08-17T13_57_09. All participants were provided with a written informed consent form, and participation was voluntary.

Data Sharing Statement. The data file for this study is available upon request.

Author Contributions Statement. As the sole author of this manuscript, I confirm sole responsibility for the study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Informed consent. All participants gave informed consent before their inclusion in the study.

Declaration of Artificial Intelligence Use. During the preparation of this work, the author used generative AI (Google Gemini) strictly

for language editing of the manuscript. After using this tool, the author reviewed and edited the content as needed and took full responsibility for the final publication's content, scientific integrity, and originality. No AI tools were used in data collection, analysis, or the generation of scientific claims.

Received: January 1, 2026
Accepted: April 14, 2026
Published Online: April 26, 2026

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