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# Top-Level Managers' Psychophysical Recovery Investigated Through Different Psychophysiological Parameters Benefits From Training Based on Muscle Relaxation and Self-monitoring of HRV-Biofeedback

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**Abstract**

**Objective.** The present study aimed to verify whether training based on progressive muscle relaxation (PMR) and self-monitoring of heart rate variability biofeedback (HRV-BFB) could lead to a significant reduction of psychophysical stress among top-level managers, measured on different physiological parameters related to the stress response. **Methods.** Thirty-four top-level managers, after completing the Symptom Questionnaire (SQ), were subjected to a psychophysiological stress profile (PSP) to describe the psychophysiological activation (Skin Conductance, surface Electromyography, Heart Rate, and Peripheral Temperature were registered in three phases: baseline, stress, and recovery). Following the intervention with PMR and HRV-BFB, SQ and PSP were readministered. **Results.** A condition of psychophysical stress was detected through SQ and PSP in the total sample at T0. The intervention allowed participants to reduce their psychological symptoms. Furthermore, muscular tension and skin conductance levels were significantly lower in the recovery phase of the PSP administered at T1. Additionally, a reduction in the reactivity to stress was observed in the HR value postintervention. **Conclusion**. Combining PMR and HRV-BFB therapy can reduce distress symptoms and improve responses to stress. It's cost-effective and offers many benefits, making it a widely recommended intervention.

***Keywords***: top-level managers; stress response; progressive muscle relaxation; heart rate variability; biofeedback

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## Introduction

Currently, mental health systems are facing challenges in addressing the increasingly high levels of stress within the population (Brinkmann et al., 2020). Stress is a complex phenomenon that occurs in response to physical or psychological threats, triggering psychological, behavioral, and physiological responses (Bali & Jaggi, 2015). If individuals do not recover sufficiently from stress, it can lead to significant risks to both physical and psychological health, and result in substantial economic costs for healthcare systems (Cooper & Dewe, 2008). Stressful situations can overload the autonomic state, causing an increase in heart rate (HR) and sweating (or skin conductance), as well as a reduction in peripheral temperature and higher levels of muscular tension (Jarczok et al., 2013).

Among the different potential sources of stress, work-related stress stands out from the most recent psychological and psychophysiological literature.

Work-related stress is considered a psychophysical response that occurs when job demands exceed employees' resources and abilities to cope with them or they clash excessively with this (National Institute for Occupational Safety and Health, 1999). The European Agreement on Stress at Work, dated October 8, 2004, defines it as a state characterized by discomfort, along with physical, psychological, and social dysfunctions, resulting from an individual's inability to meet performance expectations.

According to research (Skagert et al., 2012; Van Bogaert et al., 2014), top-level managers are particularly susceptible to work-related stress due to their high level of responsibility and the constantly evolving nature of their work (Barreto et al., 2022). This stress is further compounded in large organizations, where managers must navigate a highly competitive business sector while overseeing a large number of employees (Siegrist & Bollmann, 2023). Prolonged stress in the workplace can lead to burnout (Maslach, 1982), a syndrome characterized by exhaustion, job disaffection or cynicism, and reduced professional effectiveness.

Greater attention has been paid to the psychophysical health of workers following the European Agreement on Stress (2004) with the introduction of work-related stress risk assessment. For instance, in Italy, an adjustment to the European guidelines took place thanks to the Legislative Decree 81/2008. Consequently, the research line of Psychology of Work has enriched its literature and proposed interventions useful for the reduction of psychological distress related to the workplace. As a result, situations of chronic stress and psychophysiological activation were treated with intervention programs that were demonstrated to be useful in the management of anxious and somatic disorders (Lalanza et al., 2023). This led to the development of the Psychology of Work research line, which aims to reduce workplace-related psychological distress through various interventions such as Jacobson's progressive muscular relaxation (PMR) and biofeedback training (BFB). Studies show that these interventions are effective in managing anxious and somatic disorders. PMR has been proven to reduce anxiety, depression, sleep disturbances, chronic pain, and burnout levels (Golombek, 2001; Semerci et al., 2021). Meanwhile, BFB has shown promising results in improving autonomic imbalance, according to clinical psychophysiology studies (Dillon et al., 2016). More specifically, researchers are focusing their attention on the BFB based on heart rate variability (HRV). HRV is the variation in time between consecutive heartbeats (RR-intervals) and serves as a quantitative marker of autonomic balance and physiological stress (Malik et al., 1996). It consists of coupling and synchronizing the cardiac rhythm with the phases of respiration. Deep, regular breathing has been found to increase HR fluctuation and respiratory sinus arrhythmia, and it appears capable of optimizing the balance between sympathetic (SANS) and parasympathetic (PANS) systems (Russo et al., 2017). The two components of the autonomic nervous system (SANS and PANS) are also known as the fight-or-flight mechanism and the relaxation response, respectively (Hoareau et al., 2021; Jiménez Morgan & Molina Mora, 2017). Moreover, technological advances make it possible to make BFB-based projects increasingly usable thanks to portable medical devices that fall into the category of mHealth tools (Istepanian et al., 2004). Recent research by De Witte et al. (2019) and Schoenberg & David (2014) has revealed that wearable devices used for BFB (biofeedback) can significantly enhance the efficacy of psychological treatments for symptoms associated with psychophysiological hyperactivation. Numerous studies have demonstrated that HRV-BFB (heart rate variability biofeedback) has positive effects in alleviating symptoms of depression and anxiety (De Witte et al., 2019; Lehrer & Gevirtz, 2014; Saito et al., 2021; Schäfer et al., 2018). Additionally, psychological programs that incorporate HRV-BFB are effective in improving cardiac parameters (Lehrer & Gevirtz, 2014; Lehrer et al., 2000; Shaffer & Meehan, 2022). Despite these benefits, there is currently no research evaluating the impact of psychophysiological interventions on relaxation and other psychophysical parameters, while considering physiological parameters beyond those directly targeted. Generally, studies in the literature have assessed treatment efficacy using psychological tests (Goessl et al., 2017) or only one biofeedback parameter, such as HRV (Brinkmann et al., 2020).

After careful consideration of all factors, we determined it imperative to investigate the efficacy of an intervention incorporating Jacobson exercises and HRV-BFB. Our study aimed to examine the effects of this intervention on a range of psychophysiological parameters that reflect autonomic nervous system (ANS) activity in a cohort of high-level executives, with the ultimate goal of mitigating work-related stress.

## Materials and Methods

### Participants and Study Design

In this quasi-experimental study, 34 top managers were consecutively recruited from different multinational companies (i.e., TIM, an Italian telephone company; BNP Paribas, an international bank; Europcar, a car rental agency; eFM, a private import–export big company; Trenitalia, Italian public railway transportation; and Oracle, multinational IT company) with different locations in Italy by the Bloom (S.r.l., Rome) company. The subjects were recruited through e-mail contact by Bloom Company, and they were offered to book an in-person appointment. The 34 top managers who took part in the study were volunteers and provided informed consent before taking part in the protocol. Before administering the tests, the researchers provided information about the purpose of the study. A public presentation of the principal aims of the study and a personal individual interview was conducted. An idea of the purpose of the psychometric test administered was offered without specification of the single scale test. Once the subjects completed the administration, they were offered the option to book another appointment to receive a description of their results during a psychological interview that would be kept confidential. Criteria for inclusion in the study were age greater than 18 years old; completion of informed consent; no history of psychiatric and/or neurological syndromes (e.g., previous head trauma, epilepsy, etc.) and/or physical diseases (i.e., sensory disturbances of sight and/or hearing) that may limit the administration of the tests; and not on psychological/psychiatric or psychopharmacological treatment at the time of the recruitment. None of the participants reported previous knowledge of breathing and/or relaxation practices.

All data were handled under the ethical standards established in the 1964 Helsinki Declaration. Subjects' anonymity was preserved, and the data obtained were used solely for scientific purposes. All patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story.

### Measures

All of the participants underwent a psychological and psychophysiological assessment.

Psychopathological symptoms were assessed through the Symptom Questionnaire (SQ; Fava et al., 1983). It contains four scales based on the factorial analysis of the psychological symptoms of Anxiety (A), Depression (D), Somatization (S), and Hostility (H). Each scale can be divided into two subscales, one concerned with symptoms and the other with well-being, for a total of eight subscales. Therefore, each of the main scales includes items from both the symptoms and the well-being subscales. The clinical cutoff corresponds to four for all the scales of the test. The SQ was shown to have high sensitivity and specificity levels (80% and 76% in general practice, respectively; 86% and 74% in hospital medical wards; and 83% and 85% in emergency departments (Rucci et al., 1994). Such observations allowed this instrument to be particularly adequate, not only for the initial assessment of the patients' complex clinical profiles but also for a possible retest of the self-reported symptoms over time (Benasi et al., 2020). This test has weekly, daily, and hourly versions. For this research, the weekly version was used.

A psychophysiological stress profile (PSP; Fuller, 1979) structured in three phases was implemented. In the baseline phase (6 min), each patient was instructed to close his eyes and remain still and relaxed. In the stress phase (4 min), a mental arithmetic task (MAT) was presented to the participant. This task consisted of subtracting the number 13 from the number 1007 and continuing to subtract 13 from each successive result that was obtained. Lastly, in the recovery phase (6 min), the patient was instructed to relax again. The following parameters were continuously registered: surface frontal electromyography (sEMG), where the electrical potential was detected by means of two active electrodes placed 1 cm over the two eyebrows on the same line of the pupils and one reference electrode placed at the center of the front (2 cm of distance between poles); the skin conductance level-response (SCL-SCR), where a very low intensity electrical direct current was attained by means of two electrodes placed on the first and second finger of the nondominant hand; heart rate (HR), that consists of the detection of the electrical potential of cardiac muscle by the classic bipolar shunt for the electrocardiogram (ECG) with the possibility of calculation of inter-beat-interval (IBI) and all of the heart rate variability (HRV) data (e.g., high, very low, ultra-low and low frequencies); and peripheral temperature (PT), the peripheral body temperature recorded by a thermistor with a device placed on the thenar eminence of the nondominant hand. EMG and HR parameters were detected using surface disposable electrodes with 0.5 mm of active surface. For the SCL-SCR, two gold-plated electrodes were employed. For the PT, a very sensitive electronic thermometer (capable of evaluating fluctuations in temperature of less than 0.1°C) was utilized. The employed technology device was the “psycholab VD 13” by SATEM, Rome, Italy. The Modulab was connected by an infrared cable to a PC and all the data were detected and processed by a PC soft VD 13SV VERSION 5.0 Works program software (by SATEM, Rome, Italy). Values are considered normal if they move within their respective normal ranges: 1.7–2.5 μV for sEMG; 2.2–6.0 μS for SCL; 60–90 bpm for HR; and 31–32 °C for PT (Cacioppo et al., 2007).

### Assessment Procedure

The SQ was used as an outcome measure of the psychopathological symptoms and was administered before (T0) and after the PMR and BFB intervention (T1). In addition, the psychophysiological parameters of the PSP (sEMG, SCL-SCR, HR, and PT) were considered outcome measures to assess the benefit of the level of psychophysiological activation. A clinical psychologist who received a research fellow collected participants’ personal history and psychological and psychophysiological data.

### Intervention Procedure

The intervention was carried out by two researchers and clinical psychologists. This phase was structured as follows: the study participants underwent 10 relaxation sessions with exercises based on Jacobson's progressive muscle relaxation (PMR). The sessions were weekly and lasted 45 min. The procedure consisted of contracting muscle groups (one at a time and then all together) for 5–7 s, followed by a 20-s relaxation time. The training included an alternation of tension and relaxation of the muscles of the legs, arms, abdomen, neck, and mouth based on the classic training proposed by Jacobson (McGuigan, 1978).

The BFB training was started following the three months of the 10 relaxation sessions with PMR. The researchers were trained to lead the BFB program by a professor of psychopathology and clinical psychophysiology who was an expert in the field over a month with four lectures and guided practical exercises. In turn, researchers trained the participants to do BFB exercises independently. In particular, the participants were provided with the Inner Balance, an HRV BFB device consisting of an ear clip (photoplethysmographic sensor), a signal transformer, and software for viewing HRV cardiac data on the smartphone in real time. This app allows monitoring the sympathovagal balance independently in the absence of the operator. Participants were asked to spend 15 min per day repeating the PMR exercises and monitoring their HRV using the Inner Balance app. The researchers downloaded the HeartMath App on participants' smartphones and demonstrated how to use it. HeartMath is an mHealth intervention that teaches people to increase awareness and management of their internal states by increasing HRV through a wearable sensor. The auditory and visual feedback that is provided to the subject corresponds with the heart rhythm coherence elaborated within the Inner Balance technology of the HeartMath Institute (McCraty, 2016). For instance, the irregular heart-rhythm pattern (incoherence) is typical of negative emotions such as anger or frustration, while the coherent heart-rhythm pattern is typically observed when an individual is experiencing sustained, positive emotions and appreciation.

> A coherent heart rhythm is defined as a relatively harmonic (sine-wave-like) signal with a very narrow, high-amplitude peak in the low-frequency region (typically around 0.1 Hz) of the power spectrum with no major peaks in the other bands. Coherence is assessed by identifying the maximum peak in the 0.04–0.26 Hz range of the HRV power spectrum, calculating the integral in a window 0.030 Hz wide, centered on the highest peak in that region, and then calculating the total power of the entire spectrum. The coherence ratio is formulated as Peak Power / (Total Power − Peak Power)$^2$ (McCraty & Shaffer, 2015).

People were instructed to do HRV-BFB at least twice per day for 5 min or once each day for 10 min, every day for the 60-day study period.

### Statistical Analysis

All statistical analyses were performed using SPSS (Version 28.0.1.0; IBM Corp, Armonk, NY). Nonparametric statistical analyses were used in light of the small sample size of the sample. After descriptive statistics of the scores obtained from the total samples in the SQ scores and PSP values, the following statistics were performed: (1) comparisons between males and females on the sociodemographic characteristics (age, marital status, educational level) and the clinical features (psychological symptoms and psychophysiological activation) were calculated at baseline; (2) comparisons between the SQ scores and the PSP values obtained from the total sample at T0 and T1 were computed. The chi-square test was used for variables such as marital status and education whereas the Mann-Whitney U test was calculated for age, SQ scores, and PSP values at T0, and the Wilcoxon signed-rank sum test was used for the paired difference analysis (T0-T1) for SQ scores and PSP values.

## Results

Descriptive statistics of the sociodemographic variables clearly showed that males and females did not differ at baseline (Table 1).

**Table 1**

*Comparisons of Sociodemographic Characteristics Between Males and Females at Baseline (T0)*

| Sociodemographic features | Male (*n* = 20) | Female (*n* = 14) | Total (*n* = 34) | *U* or $\chi^2$ | *p* |
|---|---|---|---|---|---|
| Age, *M* (*SD*) | 47.95 (5.83) | 46.57 (7.39) | 47.38 (6.4) | *t*(33) = −0.53 | n.s. |
| Marital status, *N* (%) | | | | $\chi^2$ (2, *N* = 34) = 5.24 | n.s. |
| Married/cohabitant | 19 (55.88%) | 11 (32.35%) | 30 (88.24%) | | |
| Unmarried | 0 (0%) | 3 (8.82%) | 3 (8.82%) | | |
| Separated/divorced | 1 (2.94%) | 0 (0%) | 1 (2.94%) | | |
| Education Level, *N* (%) | | | | $\chi^2$ (1, *N* = 34) = 0.31 | n.s. |
| High school | 14 (41.18%) | 11 (32.35%) | 25 (73.50%) | | |
| University/post-University | 6 (17.65%) | 3 (8.82%) | 9 (26.50%) | | |

Not even considering the psychopathological symptoms, differences emerged between the two groups. However, both groups reported symptoms related to anxiety activation and irritable mood with somatic complaints above the threshold of significance (= 4). From the psychophysiological point of view, both samples appeared to be under psychophysical stress as both skin conductance and muscle tension values exceeded the upper limits of the typical values (6µS and 2.2µV, respectively; Table 2).

**Table 2**

*Comparisons of Clinical Features Between Males and Females at Baseline (T0)*

| | Male (*n* = 20) | | Female (*n* = 14) | | Total (*n* = 34) | | | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *U* (33) | *p* |
| Symptom Questionnaire | | | | | | | | |
| Anxiety | 5.00 | 2.38 | 7.29 | 4.89 | 5.94 | 3.7 | −1.34 | n.s. |
| Depression | 2.70 | 3.18 | 5.07 | 4.50 | 3.68 | 3.9 | −1.95 | n.s. |
| Somatization | 5.10 | 3.95 | 7.86 | 5.52 | 6.24 | 4.8 | −1.55 | n.s. |
| Hostility | 3.40 | 2.23 | 5.50 | 4.18 | 4.26 | 3.3 | −1.36 | n.s. |
| Psychophysiological Assessment | | | | | | | | |
| Skin Conductance | | | | | | | | |
| Baseline | 11.03 | 7.04 | 7.86 | 6.09 | 9.81 | 7.34 | −1.62 | n.s. |
| Stress | 17.62 | 10.21 | 13.91 | 7.51 | 16.19 | 9.30 | −0.89 | n.s. |
| Recovery | 16.77 | 9.84 | 11.19 | 5.96 | 16.61 | 8.88 | −1.74 | n.s. |

**Table 2**

*Comparisons of Clinical Features Between Males and Females at Baseline (T0)*

| | Male (*n* = 20) | | Female (*n* = 14) | | Total (*n* = 34) | | | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *U* (33) | *p* |
| Surface Electromygraphy | | | | | | | | |
| Baseline | 3.94 | 1.57 | 3.47 | 1.05 | 3.76 | 1.22 | −1.22 | n.s. |
| Stress | 4.79 | 1.58 | 5.73 | 1.95 | 5.16 | 1.76 | −0.95 | n.s. |
| Recovery | 3.86 | 1.46 | 4.28 | 1.19 | 4.02 | 1.36 | −1.01 | n.s. |
| Heart Rate | | | | | | | | |
| Baseline | 74.27 | 9.55 | 75.12 | 8.66 | 74.60 | 9.08 | −0.77 | n.s. |
| Stress | 86.50 | 15.34 | 84.21 | 12.23 | 85.62 | 14.05 | −0.43 | n.s. |
| Recovery | 74.07 | 11.33 | 74.46 | 9.31 | 74.22 | 10.43 | −0.59 | n.s. |
| Peripheral Temperature | | | | | | | | |
| Baseline | 32.21 | 1.57 | 32.43 | 1.24 | 32.30 | 1.43 | −0.30 | n.s. |
| Stress | 31.82 | 1.91 | 32.36 | 1.59 | 32.03 | 1.79 | −0.55 | n.s. |
| Recovery | 31.69 | 1.70 | 32.00 | 1.32 | 31.81 | 1.55 | −0.41 | n.s. |

Subsequently, a clinical-psychological and clinical-psychophysiological reevaluation was performed after the intervention. A significant reduction in psychopathological symptoms was observed. In particular, anxious activation, somatic complaints, and mood alterations were within the normal range at T1 and significantly reduced from baseline. Furthermore, a decrease in the level of skin conductance and muscle tension was observed in the recovery phase of the psychophysiological stress profile. In addition, a lower reactivity to stress was described by looking at the cardiac parameter of HR. No differences emerged regarding peripheral temperature (Table 3).

**Table 3**

*Comparison Between Pre–post SQ Scores and Psychophysiological Stress Profile Values of the Total Sample (n = 34)*

| | T0 | | T1 | | | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *Z* (33) | *p* |
| Symptom Questionnaire | | | | | | |
| Anxiety | 5.94 | 3.7 | 2.84 | 2.34 | −4.23 | < .001 |
| Depression | 3.68 | 3.9 | 1.65 | 1.06 | −4.25 | < .001 |
| Somatization | 6.24 | 4.8 | 3.65 | 3.49 | −3.32 | < .01 |
| Hostility | 4.26 | 3.3 | 1.77 | 1.94 | −2.98 | < .001 |

**Table 3**

*Comparison Between Pre–post SQ Scores and Psychophysiological Stress Profile Values of the Total Sample (n = 34)*

| | T0 | | T1 | | | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *Z* (33) | *p* |
| Psychophysiological Assessment | | | | | | |
| Skin Conductance | | | | | | |
| Baseline | 7.34 | −1.62 | 9.43 | 7.92 | −0.88 | n.s. |
| Stress | 9.30 | −0.89 | 15.89 | 10.78 | −1.39 | n.s. |
| Recovery | 8.88 | −1.74 | 12.67 | 9.71 | −2.57 | < .01 |
| Surface Electromygraphy | | | | | | |
| Baseline | 1.22 | −1.22 | 3.56 | 1.70 | −0.72 | n.s. |
| Stress | 1.76 | −0.95 | 5.07 | 2.28 | −0.36 | n.s. |
| Recovery | 1.36 | −1.01 | 2.67 | 1.28 | −3.52 | < .001 |
| Heart Rate | | | | | | |
| Baseline | 9.08 | −0.77 | 72.74 | 10.89 | −0.77 | n.s. |
| Stress | 14.05 | −0.43 | 79.20 | 13.36 | −2.21 | < .05 |
| Recovery | 10.43 | −0.59 | 71.36 | 13.15 | −1.06 | n.s. |
| Peripheral Temperature | | | | | | |
| Baseline | 1.43 | −0.30 | 32.51 | 1.81 | −0.59 | n.s. |
| Stress | 1.79 | −0.55 | 32.21 | 2.06 | −0.23 | n.s. |
| Recovery | 1.55 | −0.41 | 32.35 | 2.25 | −1.44 | n.s. |

## Discussion

This study aimed to investigate the efficacy of an intervention utilizing PMR and HRV-BFB on a group of high-ranking executives. The sample was well-diversified across gender, age, marital status, and educational attainment, with no significant gender differences noted. Participants reported experiencing anxious activation with accompanying somatic complaints, which was consistent across both groups. Furthermore, the psychological symptoms as measured by the SQ exceeded the clinical threshold for both groups, and the psychophysiological evaluation of skin conductance and muscle tension revealed values beyond the expected range. These results support prior research indicating the presence of stress-related symptoms among top-level managers (Siegrist & Bollmann, 2023; Skagert et al., 2012; Van Bogaert et al., 2014), suggesting that all participants experienced a state of psychophysical stress.

As a part of validating the proposed intervention's effectiveness, pre–post treatment comparisons were conducted. The participants benefited from the intervention, reporting decreased distress at baseline in terms of psychopathological symptoms. The clinical scales' scores, including anxiety, depression, somatizations, and hostility, were in the normal range at T1, similar to other interventional studies (Ferendiuk et al., 2019; Ghorbannejad et al., 2022; McGuigan, 1978). The training exercises proposed at the beginning of the training resulted in better muscle relaxation skills, which was reflected in lower levels of muscle tension and skin conductance observed during the recovery phase. The majority of physiological parameters showed improvement in the psychophysiological assessment. A generalization across multiple psychophysiological parameters was observed, except for the peripheral temperature parameter, which remained unchanged. The HRV-BFB training restored ANS balance globally, generating benefits that affect the whole organism. This training can activate the modulatory function of the reflexes that control the two branches of the ANS, SANS and PANS. The results of this study support the idea that HRV-BFB allows balancing the ANS and confirms the evidence of benefits in several clinical contexts (Chrousos & Boschiero, 2019; Reneau, 2020; Windthorst et al., 2017; Zucker et al., 2009). The benefits can be measured on several parameters connected to the complex system involved in the stress response. The findings of this study are consistent with the literature, which shows no evident changes in the short term for the thermoregulation processes measured within a brief psychophysiological evaluation (Bregman & McAllister, 1983).

To summarize, individuals who exhibit a lower reactivity to stress, which is indicated by the HR parameter, and a better psychophysical recovery, which can be observed with the sEMG and SCR values, tend to have a better stress response (Cannon, 1932; Selye, 1950). This was demonstrated in a study where subjects were evaluated and reevaluated using a PSP that simulates stress. By doing this, researchers were able to elicit and monitor the stress response and found that these individuals had learned to recover their psychophysical balance after experiencing stress.

Based on our initial findings, it appears that further studies are necessary to corroborate our results and address the limitations of our study. A more structured methodology, such as a randomized controlled trial, coupled with a larger sample size and the inclusion of a control group, would enable us to conduct more sophisticated statistical analyses and analyze the main effect of the intervention while controlling for confounding variables such as gender and specific temperamental traits. Our study found that the combined use of PMR and HRV-BFB did not yield conclusive evidence as to which technique is more effective in reducing work-related stress. However, our research's strength lies in its integrated treatment approach, which has provided participants with muscle relaxation exercises that they can perform independently with minimal operator costs. We utilized the HeartMath app for HRV-BFB to promote self-monitoring and equip participants with stress management skills that foster independence from the operator. Furthermore, we found it beneficial to reevaluate participants using parameters that are not under conscious control, such as psychophysiological values. Questionnaire responses may be subject to social desirability, whereas ANS activity evaluation is free from simulation. In conclusion, research indicates that cardiac coherence induction techniques are effective in managing stress in individuals with anxiety, insomnia, hypertension, and other conditions, as well as in high-risk situations as a preventive measure (Alabdulgader, 2012).

## Conclusion

Despite some limitations, this study's findings are significant and have important clinical implications. The research aimed to assess the effectiveness of a PMR and HRV-BFB intervention on high-level managers. The results demonstrate that this intervention enhanced the emotional self-regulation skills of the participants, as evidenced by the differences in various physiological parameters before and after the intervention. Specifically, participants showed lower HR levels under stress, and their skin conductance levels and muscular tension significantly decreased during the recovery phase, indicating better management of stress-induced emotions.

Overall, the study suggests that 10 guided PMR sessions and 2 months of HRV-BFB using a smartphone can effectively reduce work-related stress symptoms. This research also highlights the importance of examining both subjective and objective aspects of psychophysical well-being. Further research is necessary to validate these findings and determine the most appropriate methods for monitoring the treatment's effectiveness. These findings could pave the way for more widespread use of clinical psychological and psychophysiological assessments.

### Author Disclosures

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