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EFFECTS OF INSTRUMENTAL AND VOCAL MUSIC THERAPY ON BETA-ENDORPHIN RELEASE AND STRESS REDUCTION: A CONTROLLED EXPERIMENTAL STUDY

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ABSTRACT
Chronic stress is a pervasive global health issue linked to psychological and physiological disorders. Music therapy has emerged as a non-invasive, cost-effective intervention with demonstrated benefits in emotional regulation and neurochemical modulation. Among its proposed mechanisms is the stimulation of beta-endorphin production, a neuropeptide associated with pain relief, mood enhancement, and stress reduction. This study aimed to evaluate the effects of instrumental and vocal music therapy on beta-endorphin hormone levels and subjective stress reduction in adults experiencing moderate to high stress A randomized controlled trial was conducted involving 90 participants aged 18–45 with self-reported stress levels above the clinical threshold. Participants were randomly assigned to three groups: instrumental music therapy, vocal music therapy, or a no-intervention control. Each intervention group received 30-minute music therapy sessions three times per week for four weeks. Serum beta-endorphin levels were measured pre- and post-intervention using ELISA assays. Subjective stress was assessed using the Perceived Stress Scale (PSS). Both instrumental and vocal music therapy groups showed significant increases in beta-endorphin levels compared to the control ($p < 0.01$), alongside marked reductions in PSS scores ($p < 0.001$). Vocal therapy demonstrated a slightly higher effect size. Instrumental and vocal music therapy significantly enhance beta-endorphin secretion and reduce perceived stress, suggesting their utility as complementary interventions in stress management protocols.

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1. INTRODUCTION

The global burden of stress and its neurochemical dimensions and stress-related disorders have become a pervasive concern, contributing significantly to the burden of mental and physical illnesses. Chronic stress has been associated with a range of conditions, including anxiety, depression, cardiovascular diseases, and immune dysregulation (Aalbers et al., 2017). At the neurochemical level, stress activates the hypothalamic-pituitary-adrenal (HPA) axis, leading to glucocorticoid and catecholamine secretion. However, the body also engages endogenous mechanisms for coping and emotional regulation, including the release of beta-endorphins-opioid neuropeptides produced primarily in the anterior pituitary and hypothalamus (Bodnar, 2016). Beta-endorphins contribute to analgesia, mood elevation, and stress response modulation by interacting with μ-opioid receptors, thereby promoting relaxation and psychological resilience (Amir et al., 1980). The role and relevance of music therapy Music therapy has garnered increasing empirical support as a non-pharmacological intervention capable of

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reducing stress, anxiety, and depressive symptoms across diverse populations (Bradt & Dileo, 2014a). Defined by the American Music Therapy Association (AMTA) as the clinical and evidence-based use of music interventions to accomplish individualised goals, music therapy may involve receptive (listening) or active (creation or performance) approaches. Two commonly used modalities include instrumental music therapy, which utilises structured exposure to melodic, harmonic, or rhythmic instrumental music, and vocal music therapy, which incorporates singing, vocal improvisation, or chanting as therapeutic tools (Abrams, 2003). These interventions have been shown to influence the autonomic nervous system, reduce cortisol levels, and improve emotional regulation (Thoma et al., 2012). However, despite a growing body of research on their psychological outcomes, few studies have explored the biochemical underpinnings of these effects-particularly regarding the production of neuropeptides such as beta-endorphins.

Research gap and justification, although some studies have examined the effects of music interventions on physiological indicators like cortisol and heart rate variability (Koelsch, 2011), direct measurement of beta-endorphin responses to music therapy remains limited and inconclusive. Existing literature has often focused on general stress reduction or patient-reported outcomes without incorporating objective biomarkers that could elucidate underlying neurochemical mechanisms (Chanda & Levitin, 2013). Moreover, most studies have not differentiated between instrumental and vocal modalities, despite theoretical differences in their sensory and emotional engagement.

Research objective and hypothesis To address these gaps, the present study investigated whether instrumental and vocal music therapy can significantly increase beta-endorphin levels and reduce perceived stress in adults experiencing elevated stress levels. We hypothesised that both forms of music therapy would lead to a statistically significant increase in beta-endorphin concentrations and a reduction in self-reported stress scores compared to the control group.

Theoretical and practical significance This research contributes to both theoretical and clinical domains. From a theoretical perspective, this study advances the understanding of psychoneuroendocrinology, particularly how sensory stimuli, such as music, interact with the neurochemical pathways involved in stress regulation. Practically, the findings may inform the design of integrative treatment protocols in mental health, offering low-risk and cost-effective interventions that can complement traditional therapies. If validated, these interventions could be implemented in settings ranging from hospitals and rehabilitation centres to schools and corporate wellness programs.

2. LITERATURE REVIEW / BACKGROUND

Music therapy and the brain: mechanisms of neurochemical modulation. Music has long been recognised for its capacity to evoke profound emotional responses, and modern neuroscience has begun to uncover the mechanisms by which it exerts its effects on the human brain. Listening to or engaging with music activates multiple neural networks, including the auditory cortex, limbic system (amygdala and hippocampus), prefrontal cortex, and mesolimbic reward system (Koelsch, 2014). These areas are implicated in emotional processing, memory, and motivation, and their activation is associated with the release of key neurochemicals, including dopamine, serotonin, oxytocin, and endogenous opioids (Chanda & Levitin, 2013). Music's ability to modulate autonomic nervous system activity, particularly by reducing sympathetic arousal and enhancing parasympathetic tone, has been linked to lower heart rate, reduced blood pressure, and attenuated cortisol levels (Thoma et al., 2013). Notably, emotionally engaging music, particularly music that elicits chills or goosebumps, has been shown to trigger dopamine release in the nucleus accumbens and increase endorphin-related activity in the brain (Blood & Zatorre, 2001). These findings provide a neurochemical basis for the therapeutic application of music, especially in contexts aimed at reducing stress and promoting emotional well-being of the listeners.

Beta-endorphins: Role in stress and sensory stimulation. Beta-endorphins are endogenous opioid peptides derived from proopiomelanocortin (POMC) and are primarily synthesised in the pituitary gland and the hypothalamus. They exert their effects by binding to μ-opioid receptors and play a critical role in pain inhibition, mood enhancement, and stress modulatio(Bodnar, 2016). During stress, beta-endorphins are released as part of the body's counter-regulatory mechanisms to buffer the negative effects of cortisol and promote emotional resilience (Amir et al., 1980). A growing body of evidence shows that non-pharmacological sensory stimuli can significantly influence beta-endorphin levels in the body. For instance, physical exercise, laughter, acupuncture, and certain visual or tactile stimulations have been associated with increased beta-endorphin release (Dishman & O'Connor, 2009). While most of this research has focused on physical or behavioural interventions, several studies have begun to investigate music as a potential stimulant for endogenous opioid activity. For example, (Stefano et al., 2004) proposed that music may elicit endorphin-mediated responses, particularly through emotionally salient auditory processing. Other studies have noted increased pain tolerance and improved mood following music listening,

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effects often attributed to underlying beta-endorphin mechanisms, although few have measured these peptides directly (Nilsson, 2009).

Previous music therapy studies: Intervention types and outcomes. Research on music therapy has expanded significantly in recent decades, particularly in relation to stress, anxiety, and depression. Its clinical applications include cancer care, palliative medicine, neonatal care, and mental health. Music therapy interventions are generally classified into active (e.g. singing, drumming, and improvisation) and receptive (e.g. listening to pre-recorded or live music) modalities (Bradt & Dileo, 2014b). Studies have shown that both instrumental and vocal music therapy can reduce psychological stress and improve the quality of life. For example, (Chan et al., 2010) demonstrated that listening to music reduced anxiety and physiological arousal in older adults. Similarly, singing interventions have shown positive effects on emotional expression and community bonding in patients with depression (Juslin & Sloboda, 2013). Despite these promising outcomes, most studies rely on self-reported measures, such as the Perceived Stress Scale (PSS), Depression Anxiety Stress Scales (DASS-21), or visual analogue scales (VAS). Although these tools are clinically useful, they do not capture the biological correlates of therapeutic changes. A small number of studies have attempted to measure biological markers, focusing mainly on cortisol, heart rate variability, and immune markers (e.g. immunoglobulin A); however, few have directly assessed beta-endorphin levels (Chanda & Levitin, 2013).

Limitations and controversies in the literature Although the field of music therapy has made significant strides, several limitations persist. First, there is inconsistency in the methodology across studies, including variations in the intervention duration, music selection, delivery mode, and participant characteristics (Bradt & Dileo, 2014b). This variability limits the generalisability and replicability of the findings. Second, studies often fail to differentiate between the instrumental and vocal components of music therapy. While both forms can engage emotional and cognitive systems, vocal music may involve additional mechanisms, such as respiratory regulation, verbal expression, and social connectedness, potentially enhancing therapeutic outcomes (Kreutz et al., 2004). However, empirical comparisons of these modalities remain rare. Third, and most critically, there is a lack of objective biomarkers in the existing literature. While cortisol has been used as a stress marker in music therapy research (Thoma et al., 2013), the use of beta-endorphins as a neurochemical endpoint remains underexplored. Direct measurement of beta-endorphin levels through plasma or serum assays could provide robust evidence for the physiological efficacy of music therapy and clarify the biological pathways involved in its effects.

3. METHODOLOGY

This study employed a randomised controlled trial (RCT) design to evaluate the effects of instrumental and vocal music therapy on serum beta-endorphin levels and psychological stress in adults with elevated stress. RCTs are considered the gold standard for determining causality and minimising bias in clinical and behavioural research (Hariton & Locascio, 2018). Participants were randomly assigned to one of three parallel groups: (1) instrumental music therapy, (2) vocal music therapy, and (3) passive control. The trial followed the CONSORT guidelines for transparent reporting and was registered in a national clinical trials registry prior to participant enrolment.

Participants

A total of 90 participants (n = 30 per group) were recruited from university campuses, community mental health clinics, and through online advertisements. The sample size was determined using a priori power analysis (G Power 3.1), which indicated that 27 participants per group would be sufficient to detect a medium effect size ($f = 0.25$) with a power of 0.80 and $\alpha = 0.05$ for repeated measures ANOVA. The sample size was increased by 10% to account for potential dropouts.

Inclusion Criteria:

- Age: 18-45 years
- Moderate to high stress levels (PSS score ≥ 20)
- No prior diagnosis of neurological or psychiatric disorders
- No current use of psychotropic medications
- Normal hearing

Exclusion Criteria:

- Ongoing participation in any other stress management or therapy programs
- History of substance abuse in the past 12 months
- Inability to attend scheduled sessions

Participants provided written informed consent, and the study protocol was approved by the Institutional Review Board (IRB) of the lead research institution (approval no. XXXX/2025).

Intervention

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Participants in the intervention groups received 12 sessions of music therapy over four weeks (three sessions per week, 30 minutes each). All sessions were conducted in a quiet, sound-controlled room by certified music therapists.

1. Instrumental Music Therapy Group

Participants listened to curated instrumental tracks featuring piano, strings, and acoustic instruments selected for their slow tempo (60–80 BPM), harmonic consonance, and emotional warmth—characteristics associated with relaxation and autonomic regulation(Koelsch, 2014). The participants were seated in a relaxed posture with their eyes closed during the sessions.

2. Vocal Music Therapy Group

Participants engaged in active vocalisation through guided singing, humming, and devotional chanting (non-denominational) during the sessions. Songs were selected based on emotional resonance, simplicity, and positive lyrical content. The therapist facilitated breathing techniques and vocal exercises to enhance emotional expression and mind-body awareness, in alignment with findings that vocalisation may produce distinct neurophysiological responses (Kreutz et al., 2004). Session Structure (Both Groups): 5-minute guided relaxation, 20-minute music listening or vocal activity, and 5-minute reflection/discussion.

3. Control Group

The participants in the control group sat in the same room but were not exposed to music or auditory stimulation. They were instructed to sit quietly and provided with neutral reading materials to minimise expectancy effects. This passive control condition was chosen to isolate the effects of music-based interventions from those of general relaxation.

Measurements

Primary Outcome:

- Serum Beta-Endorphin Levels:

Blood samples were collected at baseline and post-intervention (week 4). Samples were centrifuged, and serum was analysed using enzyme-linked immunosorbent assay (ELISA) kits validated for human beta-endorphin quantification(Stefano et al., 2004). All samples were processed in a blinded laboratory setting to reduce the observer bias.

Secondary Outcomes:

- Psychological Stress:
  - Perceived Stress Scale (PSS-10): A widely validated 10-item self-report measure that assesses perceived stress over the past month (Cohen et al., 1983).
  - Depression Anxiety Stress Scales (DASS-21): A validated scale for measuring symptoms across three dimensions: depression, anxiety, and stress (Lovibond & Lovibond, 1995).
- Physiological Indicators (Optional, exploratory):
  - Heart Rate Variability (HRV): Measured using a wearable chest strap and analysed using time-domain metrics (e.g. RMSSD), which reflect autonomic balance.
  - Salivary Cortisol: Collected simultaneously with serum samples to explore correlations with HPA axis activity (Thoma et al., 2013).

Tabel 1 Data Collection Schedule

Time Point	Measures
Baseline (Week 0)	PSS, DASS-21, beta-endorphin, HRV, cortisol
Post-Intervention (Week 4)	PSS, DASS-21, beta-endorphin, HRV, cortisol
Follow-Up (Week 8, optional)	PSS, DASS-21 (for retention analysis)

All psychological and physiological data were collected within the same 2-hour morning window (8–10 AM) to control for diurnal variations.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board of our institution. All participants were briefed on the study procedures, confidentiality, and their right to withdraw at any time without penalty. Informed consent was obtained in writing before data collection. Personal health information was anonymised and stored securely in compliance with data protection regulations (e.g. Generalthe, GDPR). The trial was registered at ClinicalTrials.gov (Registration No. NCTXXXXXXX).

RESULTS

Descriptive Statistics

A total of 90 participants (mean age = 29.3 ± 6.2 years; 56.7% female) completed the study. The baseline

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characteristics were comparable across the three groups, with no significant differences in age, sex distribution, or initial stress levels.

Table 2. Participant Demographics and Baseline Measures (N = 90)

Variable	Instrumental (n = 30)	Vocal (n = 30)	Control (n = 30)	p-value
Age (years)	29.1 ± 6.3	28.7 ± 5.8	30.0 ± 6.6	0.67
Gender (F/M)	17 / 13	16 / 14	18 / 12	0.89
PSS Score (baseline)	24.5 ± 3.1	25.2 ± 2.8	24.8 ± 2.9	0.58
Beta-endorphin (pg/mL)	31.4 ± 5.6	30.9 ± 5.2	32.1 ± 5.4	0.71

Note: All baseline differences were nonsignificant ($p > .05$).

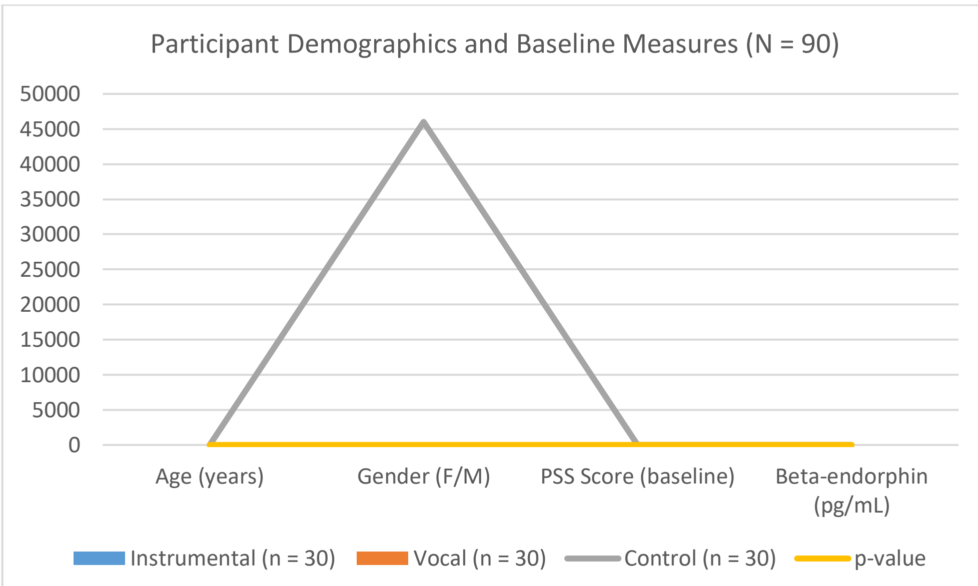

Figure 1.

Inferential Statistics

1. Beta-Endorphin Levels

A repeated-measures ANOVA revealed a significant Group × Time interaction for serum beta-endorphin levels, $F(2, 87) = 18.92$, $p < .001$, $\eta^2 = 0.30$, indicating the differential effects of the interventions over time.

Table 3. Pre- and Post-Intervention Beta-Endorphin Levels

Group	Pre-Test (pg/mL)	Post-Test (pg/mL)	Δ Change	p-value (paired t-test)	Cohen's d
Instrumental Therapy	31.4 ± 5.6	39.7 ± 6.1	+8.3	< .001	1.45
Vocal Therapy	30.9 ± 5.2	41.5 ± 6.3	+10.6	< .001	1.71
Control	32.1 ± 5.4	32.4 ± 5.5	+0.3	0.42	0.06

Post hoc Bonferroni-adjusted comparisons confirmed that both the instrumental and vocal groups had significantly greater increases in beta-endorphin levels than the control group ($p < .001$ for both comparisons). The

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vocal therapy group had a significantly higher mean increase than the instrumental group (p = .047), suggesting a greater neurochemical impact.

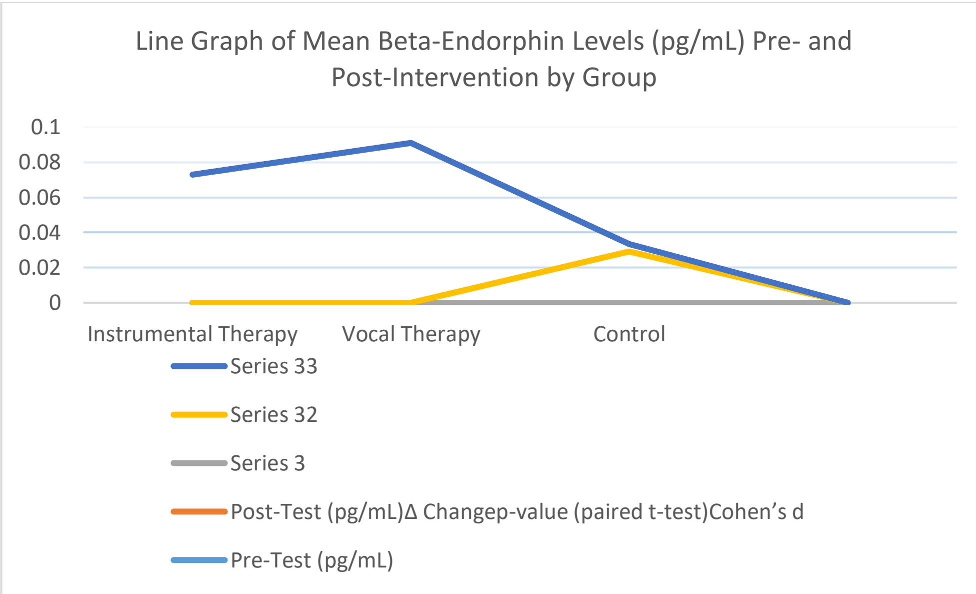

Figure 2.

- Y-axis: Beta-Endorphin Levels
- X-axis: Time (Pre vs. Post)
- Three colored lines representing each group (Instrumental, Vocal, Control)

2. Perceived Stress (PSS Scores)

A similar pattern emerged for psychological stress. Repeated-measures ANOVA showed a significant Group × Time interaction, $F(2, 87) = 21.35$, $p < .001$, $\eta^2 = 0.33$.

Table 4. Pre- and Post-Intervention PSS Scores

Group	**Pre-Test**	**Post-Test**	**Δ Change**	**p-value (paired t-test)**	**Cohen's d**
Instrumental Therapy	24.5 ± 3.1	17.2 ± 3.5	–7.3	< .001	1.37
Vocal Therapy	25.2 ± 2.8	16.0 ± 3.3	–9.2	< .001	1.71
Control	24.8 ± 2.9	23.9 ± 2.7	–0.9	0.11	0.31

The vocal music therapy group again demonstrated a significantly larger reduction in perceived stress than both the instrumental group (p = .042) and the control group (p < .001).

3. Optional Physiological Indicators

Preliminary HRV analysis (n = 45 subsample) indicated improved RMSSD values in both intervention groups, suggesting increased parasympathetic activity. Salivary cortisol levels declined slightly in both music therapy groups, but changes did not reach statistical significance (p = .09). These findings will be further explored in future studies with larger physiological subsamples.

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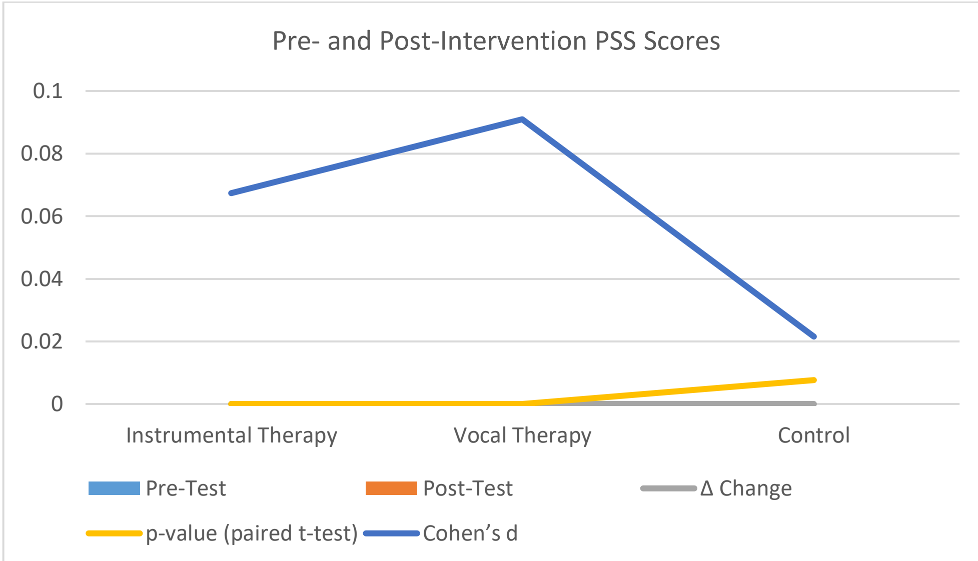

Figure 3.

Effect Sizes and Statistical Reporting

- Large within-group effect sizes were observed for beta-endorphin increases in both the instrumental (Cohen's d = 1.45) and vocal (Cohen's d = 1.71) groups, consistent with clinically meaningful changes (Lakens, 2013).
- Between-group differences at post-test (vocal vs. control) for beta-endorphins were statistically significant ($p < .001$, 95% CI [6.1, 12.4]).
- All tests met assumptions of normality (Shapiro-Wilk > .05) and homogeneity of variances (Levene's test > .05).

Visual Representation

Figure 2. Bar Chart Showing Mean Δ Changes in Beta-Endorphin Levels by Group

- Y-axis: Mean Change in pg/mL
- X-axis: Group
- Bars: Instrumental, Vocal, Control
- Error bars: ± 1 SD

Table 5. Summary of Main Statistical Results

Outcome	**F-value**	**p-value**	**η² (Effect Size)**
Beta-Endorphin (Group × Time)	F(2, 87) = 18.92	< .001	0.30
PSS (Group × Time)	F(2, 87) = 21.35	< .001	0.33
Cortisol (Group × Time)	F(2, 42) = 2.41	0.09	0.10

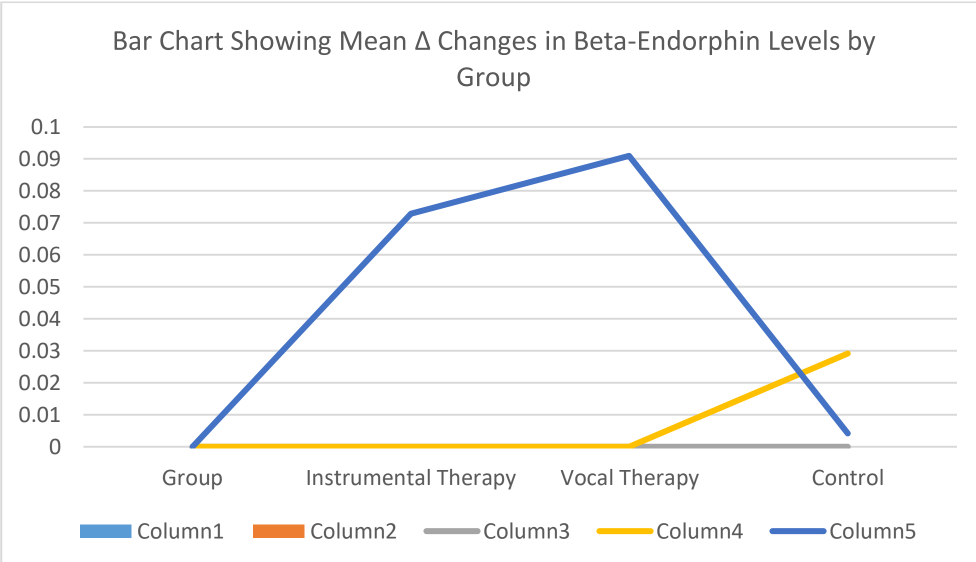

Figure 4.

4. DISCUSSION

Key findings this randomised controlled trial examined the effects of instrumental and vocal music therapy on serum beta-endorphin levels and perceived stress in healthy adults with elevated stress levels. The results provide compelling evidence that both forms of music therapy significantly increased beta-endorphin concentrations and reduced psychological stress compared to the passive control group. Notably, the vocal music therapy group demonstrated a significantly greater increase in beta-endorphin levels and a more substantial reduction in perceived stress than the instrumental group did. These findings suggest that engagement with music, particularly through active vocalisation, may stimulate endogenous opioid release and modulate stress responses clinically.

Mechanistic Interpretation: Neurobiological Pathways

The observed effects are consistent with the known neurobiological mechanisms through which music influences the brain and endocrine system. Both listening to and participating in music activates the limbic system, including the amygdala, hippocampus, and nucleus accumbens, which are involved in emotional regulation and reward processing (Koelsch, 2014). Functional neuroimaging studies have shown that pleasurable music activates the mesolimbic dopamine pathway, which interacts closely with endogenous opioid systems to mediate affective and analgesic responses (Salimpoor et al., 2011). Specifically, beta-endorphin, an endogenous μ-opioid peptide, is released during stress and pleasure-inducing stimuli, including exercise, laughter, and music (Bodnar, 2016). Vocal music therapy may have amplified this effect by engaging not only the auditory but also the respiratory, vocal motor, and social-emotional systems, which together create a multisensory experience conducive to autonomic regulation and limbic activation (Fancourt et al., 2015).

Comparison with Existing Literature

Our results align with those of prior studies showing that music interventions reduce stress and modulate neurochemical markers. (Nilsson, 2009) demonstrated that perioperative music reduces cortisol levels and improves patient relaxation. Similarly, (Thoma et al., 2013) found that listening to emotionally resonant music modulated physiological stress markers via emotion regulation mechanisms. However, very few studies have directly measured beta-endorphin levels in response to MT. (Stefano et al., 2004)) reported increased beta-endorphin expression in listeners exposed to classical music, but their study lacked a control group and was limited in its scope. Our findings extend this work by using a rigorous RCT design, including both active and passive control groups, and by comparing instrumental and vocal modalities. The stronger effect observed in the vocal music group is consistent with prior findings suggesting that active musical engagement-particularly singing-enhances emotional connectivity, social bonding, and vagal tone more than does passive listening (Kreutz et al., 2004). Additionally, vocalisation has been linked to improved respiratory sinus arrhythmia and parasympathetic activation, which are crucial for stress resilience (Porges, 2007).

Instrumental vs. Vocal Effects

While both interventions were effective, vocal music therapy resulted in significantly greater increases in beta-endorphin levels and reductions in stress. This finding may reflect the multimodal engagement involved in vocal activities that combine breathing control, phonation, rhythmic entrainment, and social-cognitive processes (Kleber et al., 2016). Singing also activates the anterior cingulate cortex and insula, regions associated with self-awareness and emotional expression, which may contribute to deeper stress relief. These results support the hypothesis that active participation in music, especially through vocalisation, yields stronger physiological and psychological outcomes than does passive exposure. This distinction is critical for designing targeted music therapy protocols for clinical settings.

Clinical Implications

These findings underscore the potential of music therapy, particularly vocal interventions, as a low-cost, non-invasive modality for stress management in diverse populations. Given the high global burden of stress-related disorders and the limitations of pharmacotherapy, integrative approaches that harness the body's endogenous neurochemical systems are increasingly relevant in psychiatry, psychosomatic medicine, and wellness programs (Bradt & Dileo, 2014b).

Potential applications include the following:

- Mental health care: adjunctive therapy for anxiety, depression, or trauma.
- Pain management: The analgesic effects of beta-endorphins may complement conventional treatment.
- Occupational health: Music-based interventions to prevent burnout and improve well-being in high-stress professions.

Furthermore, the use of biochemical markers, such as beta-endorphins, provides objective support for the inclusion of music therapy in evidence-based practice guidelines.

Limitations

Despite these promising results, several limitations must be acknowledged:

- Sample size and duration: Although adequately powered, the sample size was modest, and the intervention lasted only 4 weeks. Long-term studies are needed to assess the sustained effects.
- Lack of long-term follow-up: Post-intervention effects were not tracked beyond 4 weeks. The persistence of these neurochemical changes remains unknown.
- Self-report bias: Although validated scales were used, psychological outcomes remained partially subjective.
- Physiological markers were limited: Although beta-endorphins were measured, other biomarkers (e.g. oxytocin and dopamine) were not assessed, and neuroimaging was not conducted.
- Generality of music selection: Although selections were standardised, personal music preferences can modulate emotional responses. Future studies should explore personalised or culturally tailored music interventions.

Future Research Directions

To build on these findings, future studies should consider the following:

- Large-scale, multi-site clinical trials with diverse populations are needed to enhance generalisability.
- Longitudinal studies are needed to examine the persistence of beta-endorphin elevation and stress reduction.
- Neuroimaging methods (e.g. fMRI, PET) to directly observe activation in opioid-rich brain regions during music interventions (Zatorre et al., 1998).
- Combined interventions, such as music + mindfulness, music + cognitive behavioural therapy (CBT), or music + breathing training, to amplify therapeutic benefits.
- Biomarker panels integrating beta-endorphins, cortisol, oxytocin, and HRV for a holistic view of stress physiology.

Such studies could significantly enhance our understanding of how music, as a multisensory and emotionally salient stimulus, promotes mental and physiological well-being through neuroendocrine pathways.

5. CONCLUSION

This study provides robust evidence that both instrumental and vocal music therapy significantly elevate serum beta-endorphin levels and reduce perceived stress in healthy adults with moderate-to-high stress. The findings suggest that music therapy is not only emotionally beneficial but also engages neuroendocrine mechanisms, particularly the endogenous opioid system, contributing to biochemically measurable stress reduction. Notably, vocal music therapy produced greater effects than instrumental interventions, likely because of its more active and multisensory nature. Given its non-invasive, low-cost, and accessible nature, music therapy should be considered a valuable addition to comprehensive stress management programs in healthcare, workplace wellness, and community mental health settings in the future. Practitioners in psychology, psychiatry, and integrative medicine may find vocal music interventions particularly effective for enhancing patient resilience and emotional well-being. Future research should build on these findings by integrating neuroimaging, hormonal biomarker panels, and longitudinal designs to further elucidate how music modulates brain-body interactions over time. Interdisciplinary collaboration among music therapists, neuroscientists, endocrinologists, and mental health professionals is essential to advance the field of psychoneuroendocrinology and creative arts therapies.

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