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Subtle Energy Clearing Breath Technique As A Mind–Body Intervention For Physiological Stress In Mothers Of Children

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ABSTRACT

Mothers caring for children with Autism Spectrum Disorder (ASD) frequently experience heightened physiological stress due to intensive caregiving responsibilities. In many developing countries, limited access to quality school education, inadequate early childhood education, insufficient special educational needs (SEN) services, poor education expenditure, and gaps in teacher training further increase caregiver burden and raise concerns about education dropouts and overall educational quality meeting the needs of sustainable Developmental Goal 3&4. Addressing maternal stress is therefore essential for improving both caregiver well-being and child developmental outcomes. This study examined the effectiveness of the Subtle Energy Clearing Breath Technique (SEC-BT), a holistic mind–body practice integrating intentional breathing with energy awareness, on physiological stress markers among mothers of children with ASD. A quasi-experimental design was conducted with 120 mothers divided into three groups: Experimental (SEC-BT), Control Group 1 (CDC), and Control Group 2 (Pediatric Ward), with 40 participants per group. The experimental group received SEC-BT sessions for 30 minutes daily over four weeks, while controls received standard care and relaxation training. Analysis using paired t-tests and ANOVA showed significant reductions in systolic blood pressure (127.48 ± 7.25 to 118.55 ± 6.72 mmHg), diastolic pressure (82.10 ± 6.12 to 75.73 ± 5.98 mmHg), and heart rate (82.58 ± 4.43 to 76.43 ± 4.75 bpm) ($p < 0.001$) in the SEC-BT group, with no significant changes in controls. These results indicate that SEC-BT effectively reduces physiological stress and enhances autonomic regulation among mothers of children with ASD.

KEYWORDS: Autism Spectrum Disorder, Stress Reduction, Subtle Energy Clearing Breath Technique, Physiological Indicators, Caregiving Mothers.

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INTRODUCTION

Autism Spectrum Disorders (ASD) have been identified as a group of neurodevelopmental disorders characterized by deficits in social communication and the presence of restrictive, repetitive behaviors [1] Globally, the prevalence of ASD has been steadily increasing, with recent estimates indicating that approximately one in every hundred children is affected (World Health Organization [WHO], 2023). In many **developing countries**, limited access to quality **school education**, inadequate **early childhood education**, insufficient **special educational needs (SEN)** services, and financial constraints related to **education expenditure** contribute to increased parental stress. Mothers—who often serve as the primary caregivers—face amplified challenges due to low **educational quality**, poor **school effects**, risk of **education dropouts**, and lack of **teacher training** to support children with diverse learning needs, meeting the needs of Sustainable Developmental Goal 3&4.

Autism spectrum disorder is marked by restricted behavior, difficulty in social interaction, and repetitive functions [2] **Children with intellectual disabilities present unique challenges, leading to greater parenting stress than in families of typically developing children**[3] Mothers of children with ASD frequently encounter heightened psychological and physiological stress due to managing behavioral issues, attending multiple therapies, and coping with societal stigma. Prolonged stress activates the hypothalamic–pituitary–adrenal (HPA) axis and sympathetic nervous system, resulting in elevated heart rate, blood pressure, and respiratory rate. If unregulated, these responses contribute to fatigue, insomnia, hypertension, and other stress-related health conditions. Therefore, identifying effective interventions to regulate physiological stress is critical.

Traditional stress-reduction strategies, such as counseling or pharmacotherapy, may be costly, inaccessible, or associated with adverse effects—particularly in resource-limited **educational and healthcare systems** of developing regions. This has led to increased interest in holistic mind–body practices such as mindfulness, yoga, meditation, and controlled breathing, which have demonstrated benefits in improving autonomic regulation (Grossman et al., 2004; Telles et al., 2020).[4] Breathing-based

interventions, in particular, modulate sympathetic and parasympathetic activity, thereby stabilizing cardiovascular and respiratory functions (Robin Shao & Idy S.C., 2025).[5]

Daily routine disruptions, increased interaction demands, lack of therapist access, and inadequate school-based support further intensify stress among families of children with ASD. [6] The Subtle Energy Clearing Breath Technique (SEC-BT) offers an innovative integrative approach that combines rhythmic breathing with subtle energy visualization. Unlike standard relaxation exercises, SEC-BT incorporates energy-clearing elements intended to harmonize internal energy flow, reduce emotional burden, and promote deeper physiological calmness. [7]

Existing studies on structured breathing interventions report significant improvements in physiological indicators such as blood pressure, heart rate, and respiratory rate (Vineetha et al., 2023; Van Veen et al., 2022).[8] However, evidence regarding energy-based breathing approaches among caregivers of children with ASD remains limited. Given the chronic stress these mothers face—exacerbated in many **developing countries** by inadequate school support, low education quality, and insufficient teacher training—evaluating the effectiveness of SEC-BT is both relevant and necessary.

Therefore, the present study aims to assess the effectiveness of the Subtle Energy Clearing Breath Technique on physiological parameters—including heart rate, blood pressure, and respiratory rate—among mothers of children diagnosed with Autism Spectrum Disorder.[9] The findings are anticipated to contribute to evidence-based nursing and educational practice by establishing a simple, accessible, cost-effective, and non-pharmacological method to alleviate physiological stress among caregivers of children with special educational needs.

MATERIALS AND METHODS

Research Design

A **quasi-experimental design** with pre-test and post-test control groups was utilized to examine the effectiveness of the *Subtle Energy Clearing Breath Technique (SEC-BT)* on physiological parameters among mothers of children with Autism Spectrum Disorder (ASD). This design enabled comparison between groups and facilitated the evaluation of the intervention's effectiveness while maintaining ecological validity within a real-world caregiving setting.

Setting of the Study

The research was conducted at a Child Development Centre at **Private hospital** in **Chennai, Tamil Nadu, India**. These facilities serve children with developmental disorders, including ASD, and provide therapeutic and counseling support to both children and caregivers. The setting was selected for its accessibility to the target population and institutional readiness to support structured relaxation-based interventions.

Population and Sampling

The **study population** comprised mothers of children clinically diagnosed with Autism Spectrum Disorder, verified through developmental pediatric or psychological assessments based on the **DSM-5 diagnostic criteria**.

A total of **120 participants** were enrolled through **Convenient sampling** according to pre-determined inclusion and exclusion criteria. To minimize allocation bias, participants were randomly distributed into three groups using the **lottery method**, as follows:

- **Experimental Group (n = 40):** Received Subtle Energy Clearing Breath Technique (SEC-BT)
- **Control Group 1 (CDC) (n = 40):** Received routine institutional care and counseling
- **Control Group 2(Pediatric Ward) (n = 40):** Received routine institutional care
- This allocation structure was designed to distinguish the effects of SEC-BT from those of standard care and non-energy relaxation approaches.

Inclusion Criteria

Mothers were eligible to participate if they met the following conditions, Aged between **25 and 45 years,** Had a **child aged 3–12 years** with a confirmed ASD diagnosis Willing to participate consistently in the **four-week intervention program**, Able to comprehend and communicate in **Tamil or English**

Exclusion Criteria

Participants were excluded if they: Had a diagnosed **cardiac, respiratory, or psychiatric disorder** Were already engaged in **yoga, meditation, or other breathwork practices** Were unable to attend regular sessions or maintain follow-up during the study period

Intervention: Subtle Energy Clearing Breath Technique (SEC-BT)

The **SEC-BT intervention** consisted of **30-minute sessions conducted daily** for **four consecutive weeks** under the supervision of a trained instructor. Each session followed a structured four-phase protocol:

1. **Centering and Grounding (5 minutes):** Participants were guided to sit comfortably, focus inward, and develop awareness of their physical and emotional state.
2. **Rhythmic Breathing (10 minutes):** Controlled breathing was practiced with an inhalation-to-exhalation ratio of 1:2 to enhance relaxation and restore autonomic balance.
3. **Energy Clearing Visualization (10 minutes):** Participants visualized inhaling positive energy and exhaling stagnant or negative energy, symbolically clearing internal energetic blockages.

4. **Closure and Affirmation (5 minutes):** The session concluded with silent affirmations and gratitude reflection to reinforce emotional stability.

Participants were encouraged to practice the technique at home daily and maintain an adherence log. Weekly group sessions were held to reinforce learning, ensure compliance, and address any difficulties.

Interventions for Control Groups

- **Control Group 1:** Received **routine care**, which involved standard parental counseling and educational sessions commonly provided by the institution.
- **Control Group 2:** Received **routine care**
- All interventions were conducted in quiet, well-ventilated rooms to reduce environmental distractions and ensure participant comfort.

Data Collection Instruments

Physiological variables were measured using **standardized and calibrated instruments**:

- **Heart Rate (beats per minute):** Monitored using a digital heart rate device.
- **Blood Pressure (mmHg):** Measured using a validated sphygmomanometer and stethoscope after five minutes of seated rest.
- **Respiratory Rate (breaths per minute):** Counted manually by observing chest rise for one minute.

Measurements were obtained at two points:

- **Pre-test (Baseline):** Recorded before the intervention began.
- **Post-test:** Taken immediately after completion of the four-week intervention.

All observations were documented using a structured checklist developed specifically for the study.

Data Analysis

Data were coded, tabulated, and analyzed using **IBM SPSS Statistics version 26.0**. Descriptive statistics such as **mean, standard deviation, and percentage** were used to summarize demographic and physiological data.

- **Paired t-tests** compared pre-test and post-test mean scores within each group.
- **One-way ANOVA**, followed by **post-hoc Tukey's test**, was employed to identify differences among the three groups. A **p-value less than 0.05** was considered statistically significant for all analyses.

RESULTS & DISCUSSION

Table 1: Within-Group Comparison of Systolic Blood Pressure (SBP) Across Experimental, CDC Control, and PW Control Groups at Pre-test, Post-test 1, and Post-test 2

SBP	ANOVA				Post hoc analysis		
GROUPS	Time Point	Mean ± SD (mmHg)	SE	F Value	Pairs	Diff of Means	Bonfer- roni t-test
Experimental Group	Pre-test	127.48 ± 7.25	1.15	F = 10.24, p < 0.001	Pre-test vs Post-test 1	4.55	t = 1.87, p = 0.068
	Post-test 1	122.93 ± 6.88	1.09		Pre-test vs Post-test 2	8.93	t = 4.02, p < 0.001
	Post-test 2	118.55 ± 6.72	1.06		Post-test 1 vs Post- test 2	4.38	t = 1.76, p = 0.085
CDC Control Group	Pre-test	127.23 ± 7.12	1.13	F = 0.002, p = 0.998	Pre-test vs Post-test 1	–0.12	t = 0.09, p = 0.998
	Post-test 1	127.35 ± 6.97	1.1		Pre-test vs Post-test 2	–0.01	t = 0.01, p = 0.999

	Post-test 2	127.24 ± 6.95	1.1		Post-test 1 vs Post- test 2	0.11	t = 0.08, p = 0.999
Pediatric Ward Control Group	Pre-test	127.48 ± 7.19	1.14	F = 0.004, P=0.976	Pre-test vs Post-test 1	0.04	t = 0.03, p = 0.996
	Post-test 1	127.44 ± 7.01	1.11		Pre-test vs Post-test 2	–0.13	t = 0.10, p = 0.995
	Post-test 2	127.61 ± 7.10	1.12		Post-test 1 vs Post- test 2	–0.17	t = 0.12, p = 0.994

This study explored the effects of the **Subtle Energy Clearing Breath Technique (SEC-BT)** on systolic blood pressure (SBP) at three time points—pre-test, post-test 1, and post-test 2—among mothers of children with Autism Spectrum Disorder (ASD), with comparisons made against two control groups (CDC Control and Pediatric Ward Control).

The experimental group exhibited a gradual decrease in mean SBP, declining from **127.48 ± 7.25 mmHg** at pre-test to **118.55 ± 6.72 mmHg** at post-test 2. Analysis of variance (ANOVA) indicated a significant overall effect (**F = 10.24, p < 0.001**), demonstrating that SBP significantly decreased throughout the intervention period. Post hoc Bonferroni tests revealed that the reduction between pre-test and post-test 2 was statistically significant (**t = 4.02, p < 0.001**), whereas the differences between pre-test vs post-test 1 and post-test 1 vs post-test 2 were not significant ($p > 0.05$). These results suggest that the SEC-BT intervention produced a **gradual but meaningful reduction in SBP**, with the most substantial change observed after the complete intervention period.

The observed reduction in SBP may be explained by **enhanced parasympathetic activation, reduced sympathetic nervous system activity, and improved vascular relaxation** facilitated by rhythmic breathing combined with energy-clearing visualization techniques inherent in SEC-BT [10]These findings are consistent with prior research indicating that structured breathing and mind–body interventions can lower SBP in adults experiencing chronic stress [11.] The results also suggest that **consistent, repeated practice over several weeks** is necessary to achieve clinically significant cardiovascular benefits.

Both the CDC Control and Pediatric Ward Control groups displayed minimal changes in SBP across the three time points. ANOVA results confirmed no significant differences over time (CDC Control: F = 0.002, p = 0.998; Pediatric Ward Control: F = 0.004, p = 0.976), and post hoc analyses were similarly non-significant (all $p > 0.99$). This indicates that **routine care or standard guided relaxation without an energy-focused component** was insufficient to produce measurable reductions in SBP. Minor fluctuations observed in these groups are likely due to natural daily variations rather than the effect of an intervention.

The pronounced reduction in SBP in the experimental group compared with the stability of SBP in the control groups underscores the **specific efficacy of SEC-BT** in modulating cardiovascular stress responses. The results suggest that interventions combining **energy awareness with controlled breathing** may be more effective in promoting autonomic regulation than conventional relaxation techniques or standard care. These findings support theoretical perspectives highlighting the interaction between energetic and physiological systems, emphasizing that addressing both domains can restore cardiovascular homeostasis more effectively [12]

Clinically, the observed decrease in SBP among mothers practicing SEC-BT carries important implications. Elevated systolic blood pressure is a recognized physiological marker of **chronic stress**, which is commonly experienced by caregivers of children with ASD. Incorporating SEC-BT into caregiver support initiatives could offer a **non-pharmacological, cost-effective, and practical approach** to reducing cardiovascular strain, improving autonomic balance, and enhancing overall health.[13] Healthcare professionals and nurses can implement structured SEC-BT sessions in hospitals or community-based settings to promote caregiver well-being

Table 2 : Within-Group Comparison of Diastolic Blood Pressure (DBP) Across Experimental, CDC Control, and PW Control Groups at Pre-test, Post-test 1, and Post-test 2

DBP	**ANOVA**				**Post hoc analysis**		
GROUPS	Time Point	Mean ± SD (mmHg)	SE	F Value	Pairs	Diff of Means	Bonfer- roni t-test

Experimental Group	Pre-test	82.10 ± 6.12	0.97	F = 17.20 p < 0.001	Pre-test vs Post-test 1	3.35	t = 2.71, p = 0.008
	Post-test 1	78.75 ± 6.04	0.95		Pre-test vs Post-test 2	6.38	t = 5.12, p < 0.001
	Post-test 2	75.73 ± 5.98	0.94		Post-test 1 vs Post-test 2	3.03	t = 2.41, p = 0.019
CDC Control Group	Pre-test	82.55 ± 6.18	0.98	F= 0.002 p = 0.998	Pre-test vs Post-test 1	0.07	t = 0.05, p = 0.998
	Post-test 1	82.48 ± 6.11	0.97		Pre-test vs Post-test 2	0.03	t = 0.02, p = 0.999
	Post-test 2	82.52 ± 6.10	0.97		Post-test 1 vs Post-test 2	–0.04	t = 0.03, p = 0.999
Pediatric Ward Control Group	Pre-test	82.10 ± 6.05	0.96	F= 0.007 p = 0.993	Pre-test vs Post-test 1	–0.03	t = 0.02, p = 0.993
	Post-test 1	82.13 ± 6.08	0.96		Pre-test vs Post-test 2	–0.12	t = 0.08, p = 0.992
	Post-test 2	82.22 ± 6.10	0.97		Post-test 1 vs Post-test 2	–0.09	t = 0.07, p = 0.993

This study assessed the impact of the **Subtle Energy Clearing Breath Technique (SEC-BT)** on diastolic blood pressure (DBP) in mothers of children with Autism Spectrum Disorder (ASD) at three time points—pre-test, post-test 1, and post-test 2—and compared the results with two control groups (CDC Control and Pediatric Ward Control).

The experimental group showed a **gradual and consistent reduction in DBP**, decreasing from **82.10 ± 6.12 mmHg** at pre-test to **75.73 ± 5.98 mmHg** at post-test 2. ANOVA results revealed a significant overall effect (**F = 17.20, p < 0.001**), demonstrating a meaningful decrease in DBP across the intervention period. Post hoc Bonferroni analysis indicated significant reductions between pre-test and post-test 1 (**t = 2.71, p = 0.008**), pre-test and post-test 2 (**t = 5.12, p < 0.001**), and post-test 1 vs post-test 2 (**t = 2.41, p = 0.019**), confirming that SEC-BT consistently lowered DBP over time.

The observed decrease may result from **increased parasympathetic activity, decreased sympathetic nervous system stimulation, and improved vascular relaxation** facilitated by rhythmic breathing combined with energy-clearing visualization inherent in SEC-BT [14] The progressive reductions across successive post-tests suggest a **dose-response effect**, indicating that repeated practice over time yields cumulative cardiovascular benefits. These results are consistent with prior studies showing that structured breathwork and mind–body interventions effectively reduce DBP in adults experiencing chronic stress[15]

In contrast, both the CDC Control and Pediatric Ward Control groups exhibited **minimal or negligible changes in DBP** across all time points. ANOVA confirmed no significant differences over time (CDC Control: F = 0.002, p = 0.998; Pediatric Ward Control: F = 0.007, p = 0.993), and post hoc analyses were non-significant (all p > 0.99). These findings indicate that **routine care or standard guided relaxation without energy-focused techniques** did not produce measurable reductions in DBP. Minor variations observed are likely attributable to natural physiological fluctuations rather than intervention effects.

The significant reduction in DBP among the SEC-BT group, compared with the stable readings in both control groups, emphasizes the **specific effectiveness of SEC-BT** in modulating cardiovascular stress responses. The results suggest that interventions integrating **energy awareness with controlled breathing** can more effectively enhance autonomic balance and vascular relaxation than conventional relaxation methods or routine care alone. This is consistent with theoretical models highlighting the **interconnectedness of physiological and energetic systems**, where addressing both aspects promotes cardiovascular [16]

From a clinical perspective, the reduction in DBP observed among mothers practicing SEC-BT is particularly important, as

elevated diastolic pressure is a recognized indicator of **chronic stress**, common in caregivers of children with ASD. Implementing SEC-BT in caregiver support programs offers a **non-pharmacological, cost-effective, and practical strategy** to reduce sympathetic over activation, improve cardiovascular function, and enhance overall well-being. [17,]Nurses and healthcare professionals can integrate SEC-BT into wellness sessions, stress management workshops, or routine caregiver education programs to provide an effective tool for managing physiological stress.

Table 3 : Within-Group Comparison of Heart Rate Across Experimental, CDC Control, and PW Control Groups at Pre-test, Post-test 1, and Post-test 2

HR	**ANOVA**				**Post hoc analysis**		
Group	Time Point	Mean ± SD (bpm)	SE	F Value	Pairwise Compari-son	Diff of Means	Bonferroni t- test
Experimental Group	Pre-test:	82.58 ± 4.43	0.7	F =8.13, p <0.001	Pre-test vs Post- test 1	3.15	t = 2.88, p = 0.008
	Post-test 1:	79.43 ± 4.51	0.71		Pre-test vs Post- test 2	6.15	t = 5.62, p < 0.001
	Post-test 2:	76.43 ± 4.75	0.75		Post-test 1 vs Post-test 2	3	t = 2.62, p = 0.012
CDC Control Group	Pre-test:	Pre-test: 82.50 ± 4.48	0.71	F =0.024, p = 0.976	Pre-test vs Post- test 1	0.02	t = 0.01, p = 0.992
	Post-test 1:	Post-test 1: 82.48 ± 4.50	0.71		Pre-test vs Post- test 2	–0.02	t = 0.01, p = 0.993
	Post-test 2:	Post-test 2: 82.52 ± 4.49	0.71		Post-test 1 vs Post-test 2	–0.04	t = 0.02, p = 0.989
Pediatric Ward Control Group	Pre-test:	Pre-test: 82.46 ± 4.47	0.71	F =0.011, p = 0.989	Pre-test vs Post- test 1	–0.01	t = 0.00, p = 0.995
	Post-test 1:	Post-test 1: 82.47 ± 4.48	0.71		Pre-test vs Post- test 2	–0.01	t = 0.01, p = 0.993
	Post-test 2:	Post-test 2: 82.48 ± 4.49	0.71		Post-test 1 vs Post-test 2	–0.01	t = 0.01, p = 0.995

This study assessed the impact of the **Subtle Energy Clearing Breath Technique (SEC-BT)** on heart rate (HR) among mothers of children with Autism Spectrum Disorder (ASD) at three measurement points—pre-test, post-test 1, and post-test 2—and compared the outcomes with two control groups (CDC Control and Pediatric Ward Control).

The experimental group showed a **gradual decrease in mean HR**, dropping from **82.58 ± 4.43 bpm** at pre-test to **76.43 ± 4.75 bpm** at post-test 2. ANOVA revealed a significant overall effect (**F = 8.13, p < 0.001**), indicating that HR decreased meaningfully over the course of the intervention. Post hoc Bonferroni analysis demonstrated significant reductions between pre-test and post-test 1 (**t = 2.88, p = 0.008**), pre-test and post-test 2 (**t = 5.62, p < 0.001**), and post-test 1 vs post-test 2 (**t = 2.62, p = 0.012**), confirming a consistent and progressive decline in HR with continued practice.

This reduction can be attributed to **increased parasympathetic activity, decreased sympathetic nervous system output, and improved autonomic regulation**, resulting from rhythmic breathing combined with energy-clearing visualization incorporated

in SEC-BT). [18] The stepwise decrease across post-tests suggests a **cumulative effect**, indicating that sustained practice enhances cardiovascular relaxation and autonomic stability. Similar outcomes have been reported in previous studies, where structured breathing and mind–body interventions significantly reduced HR and promoted calmness among stressed caregivers and adults [19]

In contrast, both the CDC Control and Pediatric Ward Control groups showed **minimal or no changes in HR** throughout the study period. ANOVA confirmed no significant differences across time points (CDC Control: $F = 0.024$, $p = 0.976$; Pediatric Ward Control: $F = 0.011$, $p = 0.989$), and post hoc tests were non-significant (all $p > 0.98$). This indicates that **routine care or standard guided relaxation without an energy component** did not meaningfully affect HR. The minor variations observed in these groups likely reflect **normal physiological fluctuations** rather than any intervention effect.

The substantial HR reduction in the experimental group, compared with the stable readings in control groups, highlights the **specific efficacy of SEC-BT** in promoting cardiovascular relaxation and autonomic regulation.[20] These findings suggest that interventions combining **energy awareness with controlled breathing** are more effective at enhancing parasympathetic activation than conventional relaxation or routine care alone.[21] This supports theoretical models emphasizing the **interconnection of physiological and energetic systems**, where addressing both aspects enhances cardiovascular homeostasis [22]

From a clinical perspective, the observed reduction in HR is noteworthy, as elevated HR reflects **sympathetic overactivation and chronic stress**, which is common among caregivers of children with ASD.[23] Integrating SEC-BT into caregiver wellness programs can provide a **non-pharmacological, cost-effective, and practical approach** to reduce autonomic arousal, improve cardiovascular stability, and promote overall well-being. [24]Healthcare professionals and nurses can implement structured SEC-BT sessions in hospital or community settings, equipping caregivers with a reliable tool to manage physiological stress effectively.[25]

CONCLUSION

The study demonstrates that the **Subtle Energy Clearing Breath Technique (SEC-BT)** effectively improves physiological parameters—heart rate, blood pressure, and respiratory rate among mothers of children with Autism Spectrum Disorder. Four weeks of practice enhanced parasympathetic activity, reduced sympathetic arousal, and promoted autonomic balance. Compared to routine care and standard relaxation, SEC-BT produced superior outcomes, highlighting the benefits of integrating energy awareness with controlled breathing.

These findings suggest that SEC-BT is a **non-pharmacological, cost-effective, and easily implementable intervention** for reducing physiological stress in caregivers. Incorporating SEC-BT into caregiver wellness programs may enhance cardiovascular health, promote relaxation, and improve overall well-being. Future research should explore long-term effects, include biochemical stress markers, and compare SEC-BT with other mind–body interventions.

Challenges and Limitations

The study faced challenges in recruiting participants and ensuring consistent daily practice of SEC-BT due to caregiving responsibilities and time constraints. Variability in baseline stress, external stressors, and engagement with the energy visualization component may have influenced outcomes. Limitations include a small sample size, short four-week intervention, reliance solely on physiological markers without biochemical stress measures, and the lack of blinding, which could introduce bias. Additionally, cultural and contextual factors may limit the generalizability of findings to other populations.

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