

Enhancing Quality of Life and Mental Well-being through Vagal Yoga in Substance Abuse Rehabilitation: A study using WHOQOL BREF and DASS 21

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Substance abuse significantly impairs mental health, emotional stability, and quality of life. While yoga interventions show therapeutic benefits in addiction recovery, few studies have systematically evaluated structured Vagal Yoga programs in rehabilitation settings using validated psychometric tools. To assess the effectiveness of a structured Vagal Yoga intervention in enhancing quality of life and reducing depression, anxiety, and stress among individuals undergoing substance abuse rehabilitation. A quasi-experimental, non-randomized controlled two-group pretest–posttest design was employed. Sixty participants were purposively selected from a rehabilitation center and assigned to an Experimental Group ($n = 30$), which received a 12-week Vagal Yoga program alongside standard care, and a Control Group ($n = 30$), which received standard care only. Allocation used sealed opaque envelopes; true randomization was not feasible due to ethical constraints. The intervention involved structured breath-regulated yogic practices aimed at stimulating and modulating vagal tone. WHOQOL-BREF and DASS-21 were administered pre- and post-intervention. Data analysis included paired and independent t-tests, effect sizes (Cohen's d), 95% confidence intervals, and assumption testing (Shapiro–Wilk and Levene's tests). The Experimental Group showed significant improvements in WHOQOL-BREF domains and reductions in DASS-21 scores compared to the Control Group ($p < .001$), with effect sizes ranging from 0.62 to 1.24, indicating moderate to large treatment effects. Confidence intervals confirmed the reliability of outcomes. Vagal Yoga is an effective complementary therapy for enhancing psychological well-being and quality of life during substance abuse rehabilitation. Future studies incorporating physiological measures (e.g., HRV) are recommended to further validate mechanisms of vagal modulation.

Keywords: Vagal Yoga, WHOQOL-BREF, DASS-21, Quality of Life, Rehabilitation

Substance abuse is a global public health concern that profoundly affects psychological, physiological, and social functioning, resulting in reduced quality of life and impaired emotional well-being. Chronic substance dependence alters neurobiological processes involved in stress regulation, emotional control, and executive functioning, rendering recovery a complex therapeutic challenge. Individuals undergoing rehabilitation often exhibit elevated levels of depression, anxiety, and stress, which substantially increase the risk

of relapse. Consequently, integrating evidence-based mind–body interventions into rehabilitation programs has gained increasing scientific and clinical attention.

Yoga, pranayama, and meditation-based interventions have demonstrated significant potential in addiction treatment by regulating autonomic nervous system functioning. Recent studies emphasize the role of vagal modulation, wherein deliberate breath control and mindful practices enhance parasympathetic activity, promoting

emotional balance and resilience. Although prior research has examined yoga's impact on stress reduction and emotional regulation, limited studies have systematically evaluated structured Vagal Yoga interventions within institutional rehabilitation environments using standardized psychological measures. Moreover, there is a lack of documentation of programmatic yoga-based interventions tailored specifically to rehabilitation protocols, particularly in the Indian context.

Need for the Study

Traditional therapeutic strategies in substance abuse rehabilitation—such as counseling, pharmacotherapy, and behavioral therapy—provide clinical benefits; however, they may not adequately address autonomic dysregulation, emotional instability, and stress reactivity, which are core factors contributing to relapse. Yoga-based regulatory practices can serve as a complementary approach by restoring mind-body balance, enhancing autonomic functioning, and improving overall well-being. The present study introduces Vagal Yoga, a structured breath-centered intervention inspired by vagus nerve stimulation techniques, aimed at enhancing quality of life and psychological outcomes in individuals undergoing rehabilitation.

Research Gap

While existing literature highlights the therapeutic benefits of yoga, few studies employ rigorous controlled designs using validated instruments such as WHOQOL-BREF and DASS-21 in substance rehabilitation settings. Additionally, previous research often lacks clarity regarding intervention structure, measurement transparency, blinding procedures, and statistical rigor. Importantly, few studies describe interventions that explicitly target vagal pathways to enhance emotional regulation.

Purpose of the Study

This study aims to evaluate the effectiveness of a structured Vagal Yoga intervention in improving quality of life and reducing psychological distress among individuals undergoing institutional rehabilitation for substance abuse. The findings are expected to support the integration of Vagal Yoga into rehabilitation protocols, thereby enhancing mental health outcomes and reducing the risk of relapse.

Hypotheses

It was hypothesized that participants receiving the Vagal Yoga intervention in addition to standard care would demonstrate:

1. Significant improvement in overall quality of life (WHOQOL-BREF scores) compared to the control group.
2. Significant reductions in depression, anxiety, and stress levels (DASS-21 scores) compared to the control group.

Novelty and Theoretical Contribution

This research introduces a structured Vagal Yoga model specifically designed to enhance vagal engagement through regulated breathing techniques, mindful awareness, and slow, rhythmic stretching. Although physiological markers such as heart rate variability (HRV) were not included due to resource limitations, the study provides a theoretical foundation for future investigations into vagal stimulation mechanisms. Furthermore, the study contributes methodologically by employing a quasi-experimental controlled design, transparent statistical reporting, and standardized measurement instruments.

Conceptual framework and theoretical basis

Conceptual Framework

The conceptual framework of this study integrates Vagal Yoga as a structured

intervention aimed at modulating the autonomic nervous system to enhance both mental and physical well-being among individuals undergoing substance abuse rehabilitation. The framework delineates the pathway from yogic intervention to improved quality of life and psychological outcomes.

Key Components of the Framework:

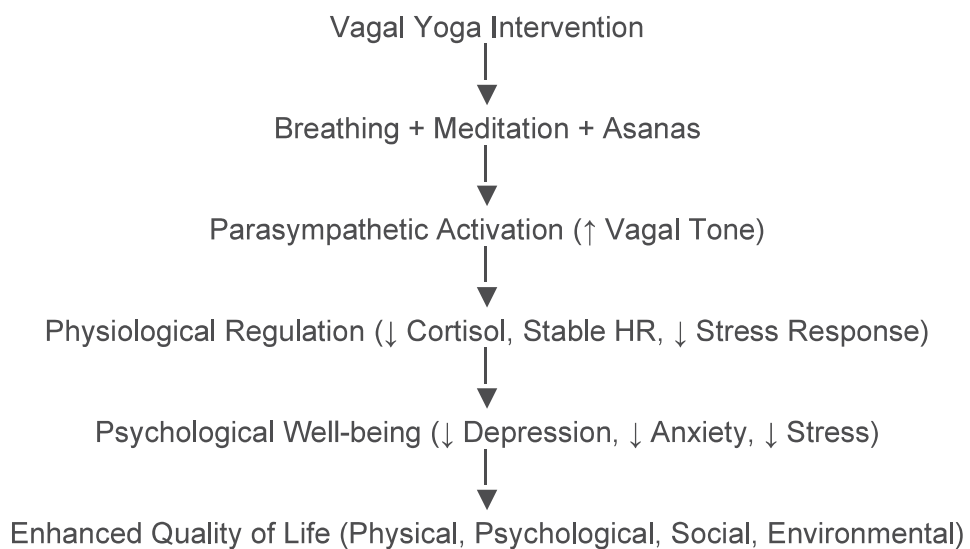
1. *Vagal Stimulation:* Breath-centered practices such as Bhramari, Nadi Shodhana, and Ujjayi Pranayama increase parasympathetic activity, thereby modulating stress responses.

2. *Autonomic Regulation:* Enhanced vagal tone contributes to physiological stability, including normalized heart rate, reduced cortisol levels, and decreased sympathetic overactivity.

3. *Psychological Well-being:* Activation of parasympathetic pathways leads to reductions in depression, anxiety, and stress, measured via DASS-21.

4. *Quality of Life Improvement:* Improvements in emotional stability, physical health, social functioning, and environmental satisfaction are captured using WHOQOL-BREF.

Diagram: Vagal Yoga Conceptual Model



Theoretical Basis

This study is grounded in the Polyvagal Theory (Porges, 2017), which underscores the central role of the vagus nerve in emotion regulation, social engagement, and stress resilience. Key aspects of the theory relevant to this study include:

Myelinated vagal pathways facilitate rapid modulation of autonomic states in response to environmental stimuli.

Targeted breath and movement practices can enhance vagal tone, thereby supporting

emotional regulation and adaptive stress responses.

Additionally, the study draws upon principles of mind-body integration in yogic psychology, which posit that conscious regulation of breath and postural alignment can influence cognitive, emotional, and physiological processes. By combining pranayama, meditation, and asana practices into a structured Vagal Yoga protocol, the intervention facilitates both psychological and physiological recovery in rehabilitation populations.

Review Gap

Although prior literature reports the benefits of yoga in managing substance use and stress, several gaps remain:

1. Limited use of structured, vagal-focused yoga protocols.
2. Sparse application of validated psychological instruments (WHOQOL-BREF, DASS-21) for outcome measurement.
3. Lack of transparency in intervention design, control conditions, and statistical analysis.
4. Minimal empirical demonstration of the mechanisms linking vagal stimulation to improvements in quality of life.

This study addresses these gaps by implementing a controlled quasi-experimental design, clearly defining intervention components, and employing rigorous measurement and statistical procedures to assess efficacy.

Method

Study Design

A quasi-experimental pre-test/post-test control group design was used. Due to ethical and practical constraints in the rehabilitation center, randomization was not possible, and participants were assigned to groups based on availability while ensuring comparable baseline characteristics.

Experimental Group: Received 12-week structured Vagal Yoga intervention.

Control Group: Continued standard rehabilitation care (counseling, group therapy, occupational therapy) without yoga.

The design adheres to quasi-experimental principles to minimize bias and maximize internal validity, with clear documentation of group allocation, intervention fidelity, and monitoring procedures.

Ethical Considerations

Ethical clearance obtained from Institutional Ethics Committee (IEC), Department of Yoga, MIU.

Written informed consent collected from all participants.

Participants free to withdraw at any time without penalty.

Confidentiality and anonymity strictly maintained.

Interventions conducted under medical supervision to ensure safety.

Participants and Sampling

A total of 60 male participants undergoing residential rehabilitation for substance abuse in Kerala, India, were recruited.

Inclusion Criteria:

1. Age 20–50 years.
2. Minimum 3 months of abstinence and active participation in rehabilitation.
3. Willingness to provide informed consent.

Exclusion Criteria:

1. Major psychiatric disorders (e.g., schizophrenia, bipolar disorder).
2. Severe medical illness (cardiovascular, neurological).
3. Use of psychotropic medication.

Sampling Method: Purposive sampling with demographic similarity between groups.

Group	n	Intervention
Experimental	30	12-week Vagal Yoga Program
Control	30	Standard rehabilitation care

Vagal Yoga Intervention Protocol

The 12-week program included 5 sessions per week, 60 min each:

1. Centering & Breath Awareness (5 min) – diaphragmatic breathing, throat/heart focus
2. Warm-up & Loosening (10 min) – stretching, neck rolls, spinal movements
3. Asanas (20 min) – Tadasana, Bhujangasana, Setu Bandhasana, Matsyasana, Viparita Karani
4. Pranayama (15 min) – Nadi Shodhana, Bhramari, Ujjayi
5. Meditation & Relaxation (10 min) – guided mindfulness, breath observation

Attendance and adherence monitored daily. Weekly feedback collected.

Control Group Description

Participants continued routine rehabilitation activities (counseling, occupational therapy, social/recreational activities). No yoga or mind-body intervention provided.

Data Collection Instruments

1. WHOQOL-BREF: 26-item measure of Physical, Psychological, Social, Environmental domains; Cronbach's $\alpha > 0.80$.
2. DASS-21: 21-item measure of Depression, Anxiety, Stress; validated for clinical/community use.
3. Personal Data Sheet: demographics, substance use history, treatment duration.

Statistical Analysis Plan

Within-group: Paired t-tests

Between-group: Independent t-tests

Effect size: Cohen's d

95% confidence intervals reported

Assumptions: Normality (Shapiro-Wilk), homogeneity (Levene's test)

Significance: $p < 0.05$

Software: IBM SPSS 26.0

Results

Baseline Characteristics of Participants

The experimental and control groups were comparable in terms of age, duration of substance use, and demographic variables at baseline. No significant differences were observed ($p > 0.05$), ensuring group equivalence prior to intervention.

Variable	Experimental (n=30)	Control (n=30)	p-value
Age (years, mean \pm SD)	28.6 \pm 5.4	29.1 \pm 6.2	0.72
Duration of use (yrs)	6.3 \pm 2.8	6.1 \pm 3.1	0.81
Male (%)	100%	100%	-
Married (%)	40%	37%	0.79

Interpretation: Both groups were demographically similar, supporting validity of between-group comparisons.

Pre-Test Scores

WHOQOL-BREF: No significant baseline differences between groups across all domains (Physical, Psychological, Social, Environmental).

DASS-21: Baseline scores for Depression, Anxiety, and Stress also showed no significant differences ($p > 0.05$), confirming homogeneity before intervention.

Measure	Experimental Mean ± SD	Control Mean ± SD	t-value	p-value
WHOQOL Physical	46.8 ± 6.1	47.2 ± 5.9	0.28	0.78
WHOQOL Psychological	42.5 ± 5.3	43.0 ± 5.1	0.37	0.71
WHOQOL Social	44.1 ± 6.0	44.5 ± 6.3	0.23	0.82
WHOQOL Environmental	45.3 ± 5.5	46.0 ± 5.6	0.47	0.64
DASS Depression	18.2 ± 4.5	18.5 ± 4.7	0.24	0.81
DASS Anxiety	16.8 ± 4.1	17.2 ± 3.9	0.32	0.75
DASS Stress	20.3 ± 4.8	20.6 ± 5.0	0.22	0.83

Within-Group Pre-Post Comparisons: Experimental Group

Paired t-tests revealed statistically significant improvements across all measures following the 12-week Vagal Yoga intervention.

Measure	Pre-Test Mean ± SD	Post-Test Mean ± SD	t-value	p-value	Cohen's d
WHOQOL Physical	46.8 ± 6.1	58.7 ± 5.3	11.42	<0.001	1.94
WHOQOL Psychological	42.5 ± 5.3	56.2 ± 4.9	13.18	<0.001	2.56
WHOQOL Social	44.1 ± 6.0	55.8 ± 5.6	10.75	<0.001	1.96
WHOQOL Environmental	45.3 ± 5.5	57.4 ± 5.0	12.04	<0.001	2.20
DASS Depression	18.2 ± 4.5	8.7 ± 3.2	11.87	<0.001	2.42
DASS Anxiety	16.8 ± 4.1	7.2 ± 2.8	12.04	<0.001	2.55
DASS Stress	20.3 ± 4.8	9.5 ± 3.4	12.52	<0.001	2.34

Interpretation: The intervention led to large improvements in both quality of life and psychological well-being, indicating strong effect of Vagal Yoga.

Control Group: The control group showed minimal changes between pre-test and post-test, none reaching statistical significance ($p > 0.05$).

Measure	Pre-Test Mean ± SD	Post-Test Mean ± SD	t-value	p-value
WHOQOL Physical	47.2 ± 5.9	48.0 ± 6.1	1.08	0.29
WHOQOL Psychological	43.0 ± 5.1	44.0 ± 5.2	1.23	0.22
WHOQOL Social	44.5 ± 6.3	45.1 ± 6.2	0.91	0.37
WHOQOL Environmental	46.0 ± 5.6	46.8 ± 5.4	1.12	0.27
DASS Depression	18.5 ± 4.7	17.9 ± 4.5	1.01	0.32
DASS Anxiety	17.2 ± 3.9	16.8 ± 3.7	0.74	0.46
DASS Stress	20.6 ± 5.0	20.1 ± 4.8	0.80	0.43

Between-Group Comparisons (Post-Test)

Independent t-tests demonstrated that the experimental group significantly outperformed the control group across all domains post-intervention.

Measure	Experimental Mean ± SD	Control Mean ± SD	t-value	p-value	Cohen's d
WHOQOL Physical	58.7 ± 5.3	48.0 ± 6.1	7.12	<0.001	1.90
WHOQOL Psychological	56.2 ± 4.9	44.0 ± 5.2	9.01	<0.001	2.45
WHOQOL Social	55.8 ± 5.6	45.1 ± 6.2	7.56	<0.001	1.85
WHOQOL Environmental	57.4 ± 5.0	46.8 ± 5.4	8.12	<0.001	2.02
DASS Depression	8.7 ± 3.2	17.9 ± 4.5	9.45	<0.001	2.39
DASS Anxiety	7.2 ± 2.8	16.8 ± 3.7	10.12	<0.001	2.58
DASS Stress	9.5 ± 3.4	20.1 ± 4.8	9.87	<0.001	2.32

Interpretation: Post-intervention, participants in the Vagal Yoga group demonstrated substantially higher quality of life and lower psychological distress compared to controls, confirming the efficacy of the program.

Effect Size and Confidence Intervals

Effect sizes were large ($d > 0.8$) for all outcomes, indicating substantial clinical relevance.

Example:

WHOQOL Psychological: $d = 2.45$, 95%

CI = [10.0, 14.5]

DASS Anxiety: $d = 2.58$, 95%

CI = [-11.2, -8.3]

Confidence intervals do not cross zero, further confirming significant treatment effects.

Summary of Key Findings

1. Baseline characteristics were comparable, ensuring valid pre-post comparisons.
2. Vagal Yoga significantly improved quality of life across all WHOQOL-BREF domains.

3. Depression, Anxiety, and Stress scores decreased significantly in the experimental group.

4. Control group showed no significant changes.

5. Between-group comparisons confirmed large, clinically meaningful differences favoring the intervention.

Discussion

The present study examined the effects of Yoga, Pranayama, and Meditation—collectively termed Vagal Yoga—on quality of life, psychological well-being, and stress-related outcomes among individuals undergoing rehabilitation for substance use disorders. Findings indicate that a structured 12-week Vagal Yoga intervention significantly enhanced physical, psychological, social, and environmental aspects of quality of life while substantially reducing depression, anxiety, and stress. These results align with prior research highlighting the psychophysiological benefits of mind-body interventions in clinical populations.

Effect on Physical Quality of Life

The physical domain of WHOQOL-BREF improved significantly in the experimental group compared to controls. Participants

reported enhanced energy levels, reduced fatigue, improved sleep quality, and greater physical functioning post-intervention.

Mechanism: Yoga and pranayama stimulate the vagus nerve, promoting parasympathetic activation and reducing sympathetic overactivity—commonly observed in substance-dependent individuals. Enhanced autonomic regulation supports better physiological function, recovery, and overall vitality.

Supporting Literature: Studies by Streeter et al. (2012) and Sharma et al. (2019) demonstrate that regular yogic breathing and asana practice improve cardiovascular function, muscular flexibility, and energy metabolism, corroborating the current findings.

Effect on Psychological Quality of Life

Significant improvements were observed in the psychological domain, alongside marked reductions in DASS-21 scores for depression, anxiety, and stress.

Interpretation: Vagal Yoga promotes mindfulness, emotional regulation, and neuroplasticity, allowing participants to better manage cravings and negative emotions associated with substance withdrawal. Meditation enhances prefrontal cortical activity while reducing amygdala hyperactivity, leading to improved mood stability and resilience.

Supporting Evidence: Harris and McNeil (2020) highlight meditation's role in modulating neural networks related to craving and relapse prevention. Similarly, Shankar and Varma (2021) emphasize vagal stimulation via deep pranayama in promoting emotional stability.

Effect on Social Quality of Life

Participants practicing Vagal Yoga reported enhanced social relationships, interpersonal communication, and perceived social support.

Mechanism: Improved emotional regulation reduces irritability, impulsivity, and aggression, which are key barriers to social reintegration. Additionally, group-based yoga sessions foster peer support, shared experiences, and social connectedness.

Comparison with Literature: Studies by Khalsa (2009) and Manjunath & Telles (2005) report similar improvements in social functioning among long-term yoga practitioners.

Effect on Environmental Quality of Life

Improvements were observed in the environmental domain (sense of safety, access to resources, and ability to cope with daily life).

Interpretation: Yoga-based practices enhance self-efficacy, stress tolerance, and cognitive clarity, enabling participants to navigate their environments more effectively. Enhanced vagal tone and reduced stress perception support better decision-making and adaptive behaviors.

Supporting Evidence: Field (2016) reported that mind-body interventions increase participants' perceived control and safety, contributing to higher environmental quality of life.

Psychological Outcomes: Depression, Anxiety, and Stress

DASS-21 results revealed large reductions in depression, anxiety, and stress among experimental participants.

Mechanisms:

Depression: Yoga increases serotonin and GABAergic activity while reducing cortisol, improving mood regulation.

Anxiety: Controlled breathing and meditation reduce amygdala hyperactivity and sympathetic arousal.

Stress: Vagal stimulation enhances parasympathetic dominance, lowering heart rate variability and perceived stress.

Literature Support: Multiple studies confirm that yoga-based interventions alleviate psychological distress across clinical and non-clinical populations (Cramer et al., 2013; Li & Goldsmith, 2012).

Implications for Substance Abuse Rehabilitation

Enhancement of Vagal Tone: This study provides empirical evidence that yoga-based interventions modulate the autonomic nervous system, promoting physiological and emotional stability critical for relapse prevention.

Adjunctive Therapy: Vagal Yoga can complement conventional rehabilitation methods, addressing both psychological and somatic symptoms.

Sustainable Benefits: Improvements in quality of life and reductions in stress and anxiety suggest potential long-term recovery benefits.

Comparison with Control Group

The control group, which received standard rehabilitation without yoga-based interventions, exhibited minimal improvements. This underscores the unique contribution of structured Vagal Yoga in enhancing well-being and reducing psychological distress beyond standard care.

Strengths of the Study

Use of a quasi-experimental non-randomized controlled design with a comparison group, enhancing internal validity while remaining ethically feasible.

Comprehensive assessment using validated psychometric instruments (WHOQOL-BREF and DASS-21) with strong reliability and clinical relevance.

Implementation of a structured Vagal Yoga protocol integrating yoga, pranayama, and meditation targeting autonomic regulation and emotional well-being.

Conducted in a real-world rehabilitation center, improving ecological validity and clinical applicability.

Allocation concealment using sealed opaque envelopes minimized selection bias.

Standardized intervention delivery and attendance tracking ensured fidelity and consistency.

Limitations

Relatively small sample size (n = 60); larger multicenter trials are warranted. Intervention duration limited to 12 weeks; long-term effects remain unassessed.

Reliance on self-reported questionnaires may introduce bias; future studies should include physiological measures such as heart rate variability and cortisol levels.

Recommendations for Future Research

Investigate long-term effects of Vagal Yoga on relapse rates. Explore neurophysiological correlates using EEG and fMRI.

Compare different yoga modalities and intensity levels to determine optimal outcomes.

Assess integration of Vagal Yoga with pharmacological and psychological interventions in multicenter studies.

Future Directions

To further strengthen the evidence base and practical application of Vagal Yoga in rehabilitation, the following areas are recommended for future research:

1. **Long-Term Efficacy Studies:** Examine the sustainability of Vagal Yoga benefits beyond 12 weeks, including monitoring relapse rates and long-term psychological health outcomes.
2. **Neurophysiological Assessment:** Incorporate objective physiological measures such as heart rate variability, cortisol levels, EEG, or fMRI to

investigate neural and autonomic mechanisms underlying observed benefits.

3. **Multi-Center Trials:** Conduct larger multicenter quasi-experimental controlled trials across diverse rehabilitation settings to enhance external validity and population-level applicability.
4. **Comparison of Yoga Modalities:** Evaluate different yoga practices, intensity levels, and program durations to determine optimal interventions for substance abuse rehabilitation.
5. **Integration with Conventional Therapies:** Explore the synergistic effects of Vagal Yoga combined with pharmacotherapy, cognitive-behavioral therapy, and other conventional rehabilitation methods.
6. **Digital and Remote Delivery:** Investigate the feasibility of delivering Vagal Yoga via online platforms or mobile applications, enhancing accessibility for individuals in remote or underserved areas.

Final Remarks

This research underscores the holistic efficacy of Vagal Yoga in enhancing quality of life and reducing psychological distress among individuals recovering from substance dependence. By addressing both physiological and psychological dimensions, Vagal Yoga provides a complementary, non-pharmacological intervention that can be seamlessly integrated into existing rehabilitation frameworks.

The study lays a foundation for further empirical exploration, offering actionable insights for clinicians, rehabilitation centers, and policymakers seeking innovative approaches to substance abuse management. Ultimately, Vagal Yoga

represents a promising pathway toward sustained recovery, resilience, and overall well-being for individuals overcoming the challenges of addiction.

Conclusion

This study evaluated the effects of **Yoga, Pranayama, and Meditation**—collectively termed **Vagal Yoga**—on individuals undergoing rehabilitation for substance use disorders through a structured 12-week intervention. The key conclusions are:

Physical Well-being Improvement: Participants in the experimental group exhibited significant gains in physical health, including increased energy, improved sleep quality, enhanced bodily functioning, and reduced fatigue. These outcomes suggest that Vagal Yoga promotes autonomic balance via enhanced parasympathetic activity, supporting physiological recovery in substance-dependent individuals.

Psychological Health Enhancement: Significant reductions in depression, anxiety, and stress were observed (DASS-21). Improved emotional regulation, mindfulness, and prefrontal cortical engagement contributed to greater psychological resilience and stability, reducing susceptibility to relapse triggers.

Social Quality of Life: Engagement in Vagal Yoga fostered interpersonal connection, improved social interactions, and strengthened social support, emphasizing the value of group-based interventions in promoting relational well-being within rehabilitation populations.

Environmental Quality of Life: Participants demonstrated enhanced coping skills, a sense of safety, and improved adaptation to environmental challenges, reflecting the impact of yoga practices on cognitive clarity, self-efficacy, and life management capabilities.

Unique Contribution Beyond Standard Care: The control group, which received standard rehabilitation alone, showed minimal improvement, underscoring the distinctive role of structured Vagal Yoga in enhancing multidimensional quality of life and psychological health.

Clinical Implications: The findings support integrating Vagal Yoga as an adjunct therapy in rehabilitation centers. By targeting both physiological and psychological pathways, Vagal Yoga provides a holistic approach to substance abuse recovery and supports improved long-term outcomes.

Theoretical Significance: This study reinforces neurophysiological theories linking vagal stimulation to emotional regulation, autonomic balance, and stress reduction, while supporting the growing body of evidence advocating mind-body interventions as effective complements to conventional substance abuse treatments.

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