

## Integrating Ayurgenomics and Yoga Chikitsa in Non-Specific Chronic Low Back Pain: A Case Series on Functional Disability and Stress

Padmashanti Nilachal<sup>1</sup>, Ananda Balayogi Bhavanani<sup>2\*</sup>, Meena Ramanathan<sup>3</sup>, Vandana Srivastava<sup>4</sup> Rajarajan D<sup>5</sup>

<sup>1</sup>Ph.D Scholar, School of Yoga Therapy, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry, India

<sup>2\*</sup>Director, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry, India

<sup>3</sup>Principal, School of Yoga Therapy, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry, India

<sup>4</sup>HoD, Department of Ayurveda and Holistic Health, Dev Sanskriti Vishwavidyalaya Gayatrikunj-Shantikunj, Haridwar (Uttarakhand), India

<sup>5</sup>Associate Professor, M.S Orthopaedics, MGMC & RI Hospital, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry, India

\*Corresponding Author: Dr. Ananda Balayogi Bhavanani (yognat@gmail.com), Director, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth (Deemed to be University), Pondicherry, India

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### ABSTRACT

**Background:** Non-specific chronic low back pain is a multifactorial condition shaped by biomechanical, psychological, and constitutional factors. Ayurgenomics, which integrates Ayurvedic prakriti classification with physiological profiling, may explain inter-individual variability in treatment response. Recently, a standardized Generic Yoga Therapy Protocol comprising 18 validated techniques has been developed for NCLBP through expert consensus.

**Objective:** To explore how individuals with different prakriti types respond to a uniform 6-week Yoga Therapy protocol using standardized Ayurgenomic profiling via AyuSoft.

**Methods:** Six adults with clinically diagnosed NCLBP and varied prakriti types were selected to reflect constitution-based diversity. Each underwent prakriti assessment using AyuSoft developed by Centre for Development of Advanced Computing (C-DAC) and was classified into pradhāna–anubandha types. All participants completed a 6-week, 40-minute validated Yoga Therapy protocol. Outcomes were measured pre- and post-intervention using the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), and Perceived Stress Scale (PSS).

**Results:** All participants demonstrated clinically meaningful improvement in functional disability. Response patterns differed by prakriti:

Kapha-pradhāna individuals showed consistent improvements across physical and psychological domains.

Pitta-pradhāna individuals showed rapid pain relief but varied emotional recovery.

Vāta-pradhāna participants exhibited notable stress reduction with limited pain change.

**Conclusion:** The standardized 40-minute Yoga Therapy protocol yielded functional and psychological benefits across all six NCLBP cases. Observed variability in therapeutic response aligned systematically with Ayurgenomic profiles, supporting prakriti-based personalization in yoga-based rehabilitation.

**KEYWORDS:** Ayurgenomics, Prakriti, Yoga Chikitsa, Yoga Therapy, Chronic Low Back Pain, AyuSoft, Personalized Rehabilitation.

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**How to Cite:** Padmashanti Nilachal, Ananda Balayogi Bhavanani, Meena Ramanathan, Vandana Srivastava, Rajarajan D., (2025) Integrating Ayurgenomics and Yoga Chikitsa in Non-Specific Chronic Low Back Pain: A Case Series on Functional Disability and Stress, Vascular and Endovascular Review, Vol.8, No.17s, 192-200

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### INTRODUCTION

Non-specific chronic low back pain represents a primary contributor to global disability, encompassing not only musculoskeletal impairments but also elements of stress physiology, emotional reactivity, and lifestyle influences [1,2]. Conventional interventions, such as physical therapy, pharmacotherapy, and ergonomic adjustments, frequently yield suboptimal outcomes owing to the multifaceted etiology of NCLBP. [3,4]

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Ayurgenomics provides an integrative paradigm that correlates Ayurvedic prakriti typology with contemporary genomic and physiological profiles, thereby elucidating inter-individual differences in treatment responses.[5,6] Distinct prakriti constitutions are associated with variations in metabolic processes, structural integrity, psychological attributes, and inflammatory responses, which can modulate rehabilitative efficacy.[5,7–9]

Yoga Therapy or Yoga Chikitsa, an encompassing mind-body modality incorporating asanas, pranayama, relaxation techniques, and interoceptive practices, has evidenced efficacy in managing chronic low back pain.[10–13] A standardized Generic Yoga Therapy Protocol for NCLBP, consisting of 18 evidence-based techniques derived from meta-analytic synthesis and international expert consensus, has recently been formulated.[14] Notwithstanding its uniformity, response trajectories diverge across patients in terms of velocity and targeted domains.

This case series delineates the application of Ayurgenomic profiling through AyuSoft to account for heterogeneous responses to a non-personalized, standardized yoga therapy regimen among individuals with varying prakriti profiles.

## METHODS

### 2.1 Study Design

Six individuals clinically diagnosed with non-specific chronic low back pain (NCLBP) were purposively selected to represent diverse *prakriti* types, ensuring constitution-based variation in the study sample. *Prakriti* was assessed using AyuSoft, a standardized diagnostic tool developed by the Centre for Development of Advanced Computing (C-DAC), which generates both *pradhāna* (dominant) and *anubandha* (secondary) dosha profiles.

### 2.2 Participants

#### Study Population

All patients diagnosed with Non-specific Chronic Low Back Pain at Dept. of Orthopedics MGMC&RI.

#### Inclusion Criteria

- Age >18 years and <65 years
- Chronic low back pain (>12 weeks) refractory to medical management
- Subjects having low back pain for at least 3 months

#### Exclusion Criteria

- Spinal pathologies (infection, tumor, etc.)
- Spinal stenosis
- Scoliosis
- Fracture of vertebra
- Previous back surgeries

### 2.3 Outcome Measures

- **VAS - Visual Analogue Scale**

VAS is a simple, sensitive tool used to quantify subjective pain intensity. Participants rate their pain on a 10-cm line ranging from “no pain” to “worst imaginable pain.” It captures moment-to-moment perception of pain and is useful for detecting short-term changes in pain severity.

- **ODI - Oswestry Disability Index**

The ODI is a widely validated measure assessing the degree of functional disability caused by low back pain. It evaluates limitations across daily activities such as walking, sitting, standing, and self-care. Higher scores indicate greater disability. It is considered the gold standard for assessing functional impairment in spinal conditions.

- **PSS - Perceived Stress Scale**

The Perceived Stress Scale, developed by Sheldon Cohen, assesses the extent to which individuals perceive situations in their lives as stressful. Its items are designed to gauge respondents' perceptions of life's unpredictability, uncontrollability, and overload. Tailored for community samples with at least a junior high school education, the PSS features comprehensible items and straightforward response alternatives.

### 2.4 Ayurgenomic Profiling via AyuSoft

Prakriti assessment was conducted using AyuSoft, a computerized diagnostic system designed by the Centre for Development of Advanced Computing (C-DAC). AyuSoft evaluates anatomical, physiological, and psychological traits to classify individuals into ten prakriti categories, which expand upon classical Ayurvedic prakriti theory.

AyuSoft utilizes *pradhāna-anubandha* logic, where the first dosha denotes dominant influence and the second represents a secondary regulatory influence.

**Table 1. Different Prakriti Types According to AyuSoft**

Type	Prakriti Classification	Dominant Dosha
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1	Ekaantika Vaata Prakriti	Vaata
2	Ekaantika Pitta Prakriti	Pitta
3	Ekaantika Kapha Prakriti	Kapha
4	Kaphapradhaana Pittaanubandhi Prakriti	Kapha-Pitta
5	Kaphapradhaana Vaataanubandhi Prakriti	Kapha-Vaata
6	Pittapradhaana Kaphaanubandhi Prakriti	Pitta-Kapha
7	Pittapradhaana Vaataanubandhi Prakriti	Pitta-Vaata
8	Vaatapradhaana Kaphaanubandhi Prakriti	Vaata-Kapha
9	Vaatapradhaana Pittaanubandhi Prakriti	Vaata-Pitta
10	Sama Prakriti	Balanced tridosha (rare and ideal)

## 2.5. Participant Characteristics

**Table 2: Participants with different deha prakriti**

Case	Prakriti Classification (AyuSoft)	Age	Gender
1	Kaphapradhaana Pittaanubandhi Prakriti	25	Female
2	Kaphapradhaana Vaataanubandhi Prakriti	50	Male
3	Pittapradhaana Kaphaanubandhi Prakriti	42	Female
4	Pittapradhaana Vaataanubandhi Prakriti	33	Male
5	Vaatapradhaana Pittaanubandhi Prakriti	56	Male
6	Vaatapradhaana Kaphaanubandhi Prakriti	42	Female

## 2.6 Intervention: Generic Yoga Therapy Protocol for NCLBP [14]

All participants completed a validated 18-practice, 40-minute Yoga Therapy protocol, including:

- **Standing (3 min):**  
Tadasana, Ardha Uttanasana, Uttanasana
- **Spinal Mobility (3 min):**  
Marjariasana
- **Pranayama (12 min):**  
Anuloma Viloma, Nadi Shuddhi, Vibhagiya Pranayama, Bhramari
- **Forward Fold & Rest (1 min):**  
Adho Mukha Virasana
- **Prone Strengthening (4 min):**  
Makarasana, Bhujangasana, Ardha Shalabhasana, Shalabhasana
- **Supine Practices (7 min):**  
Supta Tadasana, Apanasana, Supta Pawanmuktasana, Setubandhasana
- **Deep Relaxation (10 min):**  
Savasana

**Schedule:**

- 2 supervised sessions/week
- 3 home-practice sessions/week
- **Duration:** 6 weeks

**CASE DESCRIPTIONS**

This case series comprises six adults clinically diagnosed with non-specific chronic low back pain, each assessed and classified according to their Deha Prakriti using the AyuSoft diagnostic system. All participants underwent an identical six-week standardized Yoga Therapy protocol, with outcomes evaluated via validated instruments including VAS (pain), ODI (disability) and PSS (stress). Consistent with Ayurgenomic principles, pre-intervention Prakriti profiling provided a personalized constitutional framework for interpreting responses. Despite this uniform intervention, outcomes varied substantially across physical and psychological domains. The following case descriptions detail each participant's baseline profile, post-intervention changes, and prakriti-modulated recovery trajectory.

**3.1. Case 1: Kaphapradhaana Pittaanubandhi Prakriti (25-year-old Female)**

A 25-year-old female with Kaphapradhaana pitta-anubandhi Prakriti presented with mild low back pain (VAS=3), moderate functional disability (ODI=24), and high perceived stress (PSS=18). Following a structured six-week Yoga Therapy protocol, clinically relevant improvements were observed across all outcome domains. Specifically, pain intensity reduced by 33.3% (VAS=2), functional disability improved by 41.7% (ODI=14), and perceived stress decreased by 44.4% (PSS=10), shifting from high to low stress levels.

**Outcome Measures (Case 1)**

Outcome	Pre	Post	Change	% Change
VAS	3	2	-1	33.3% ↓
ODI	24	14	-10	41.7% ↓
PSS	18	10	-8	44.4% ↓

**Ayurgenomic Interpretation:**

Kapha pradhana offered physiological stability and endurance for functional gains, while Pitta anubandha supported metabolic responsiveness and pain relief. Pranayama likely balanced Pitta-driven stress, enabling strong psychophysical recovery beyond Vata-dominant cases. This highlights Yoga Chikitsa's value for Kapha-Pitta profiles, as evidenced by prakriti specific ODI patterns across cases.

**3.2. Case 2: Kaphapradhaana Vaataanubandhi Prakriti (50-year-old Male)**

A 50-year-old male with Kaphapradhaana Vaataanubandhi Prakriti presented with mild pain (VAS: 3), moderate functional disability (ODI: 32%), and high perceived stress (PSS: 18). Following a six-week Yoga Chikitsa intervention, pain decreased to 2 (33.3% reduction), disability improved to 22.98% (28.2% reduction), and stress levels reduced markedly to 10 (44.4% reduction), indicating a shift from high to low perceived stress.

**Outcome Measures (Case 2)**

Outcome	Pre	Post	Change	% Change
VAS	3	2	-1	33.3% ↓
ODI	32	22.98	-9.02	28.2% ↓
PSS	18	10	-8	44.4% ↓

**Ayurgenomic Interpretation:**

Kapha predominance likely facilitated therapeutic adherence and physical resilience, whereas the Vaata component, typically associated with emotional lability and heightened stress reactivity, was probably modulated through Pranayama. This case exemplifies the efficacy of prakriti-tailored yoga therapy in attaining psychosomatic equilibrium and enhancing functional outcomes within a concise intervention period.

**Case 3: Pittapradhaana Kaphaanubandhi Prakriti (42-year-old Female)**

A 42-year-old female with *Pittapradhaana Kaphaanubandhi Prakriti* presented with mild pain (VAS: 3), severe functional disability (ODI: 44.4%), and very high perceived stress (PSS: 21), suggestive of significant psychosomatic burden. After six weeks of Yoga Chikitsa intervention, the participant exhibited substantial functional and psychological improvement, with a 36.9% reduction in disability (ODI: 28) and a 38.1% reduction in stress levels (PSS: 13). However, pain intensity remained unchanged (VAS: 3), highlighting a dissociation between subjective pain and functional recovery.

**Outcome Measures (Case 3)**

Outcome	Pre	Post	Change	% Change
VAS	3	3	0	0%
ODI	44.4	28	-16.4	36.9% ↓
PSS	21	13	-8	38.1% ↓

**Ayurgenomic Interpretation:**

The prakriti constitution provides interpretive value: the predominant Pitta dosha likely promoted robust physiological responses and enhancements in structural function, whereas the subsidiary Kapha influence, typically associated with emotional stagnation and psychological lethargy, may have tempered the rate of emotional and sensory adaptations. This instance illustrates a trajectory where improvements in functionality outpace alterations in pain perception and mood, a trend noted in select Pitta Kapha constitutions receiving integrative therapeutic interventions.

**Case 4: Pittapradhaana Vaataanubandhi Prakriti (33-year-old Male)**

A 33-year-old male with *Pittapradhaana Vaataanubandhi Prakriti* presented with moderate pain (VAS: 6), moderate functional disability (ODI: 40%), and very high perceived stress (PSS: 24) at baseline. Following six weeks of Yoga Chikitsa, he experienced the most significant pain reduction among all cases (VAS: 6 to 2; 66.7% decrease), indicating excellent somatic responsiveness. However, functional disability showed only marginal improvement (ODI: 36; 10% reduction), and stress levels remained high despite a slight decrease (PSS: 21; 12.5% reduction).

**Outcome Measures (Case 4)**

Outcome	Pre	Post	Change	% Change
VAS	6	2	-4	66.7% ↓
ODI	40	36	-4	10% ↓
PSS	24	21	-3	12.5% ↓

**Ayurgenomic Interpretation:**

Pitta dominance may have enabled rapid pain relief and musculoskeletal recovery, while Vaata anubandha fueled persistent psychological hyperactivity and instability, limiting emotional regulation and functional gains. Physical improvements substantially outpaced psychological adjustment, characteristic of Pitta-Vaata types prone to volatility.

**Case 5: Vaatapradhaana Pittaanubandhi Prakriti (56-year-old Male)**

A 56-year-old male with *Vaatapradhaana Pittaanubandhi Prakriti* presented with mild pain (VAS: 3), moderate functional disability (ODI: 28%), and very high perceived stress (PSS: 26) at baseline. Following a six-week Yoga Chikitsa intervention, the participant exhibited a 28.6% reduction in disability (ODI: 20) and a 42.3% reduction in stress levels (PSS: 15). Pain levels remained unchanged (VAS: 3).

**Outcome Measures (Case 5)**

Outcome	Pre	Post	Change	% Change
VAS	3	3	0	0%

<b>ODI</b>	28	20	-8	-28.6% ↓
<b>PSS</b>	26	15	-11	-42.3% ↓

**Ayurgenomic Interpretation:**

The participant's Vaatapradhaana Pittaanubandhi prakriti likely shaped the therapeutic outcomes. Vaata predominance, characterized by heightened sensory perception, mental restlessness, and fluctuating energy, likely contributed to persistent pain despite other improvements. The Pitta component supported focused engagement, enabling functional gains and stress reduction. The structured, calming, and repetitive elements of Yoga Chikitsa likely stabilized the Vaata imbalance, yielding notable psychological recovery. This pattern of selective improvement in stress and function, without pain change, aligns with typical Vaata Pitta constitutional dynamics, where psychological regulation often precedes somatic recalibration.

**Case 6: Vaatapradhaana Kaphaanubandhi Prakriti (42-year-old Female)**

A 42-year-old female with *Vaatapradhaana Kaphaanubandhi Prakriti* presented with moderate pain (VAS: 4), minimal functional disability (ODI: 23%), and high perceived stress (PSS: 18) at baseline. Following a six-week Yoga Chikitsa intervention, the participant demonstrated a 13.0% improvement in disability (ODI: 20%) and a 33.3% reduction in stress levels (PSS: 12%). Pain intensity remained unchanged (VAS: 4). This outcome pattern suggests that while nociceptive symptoms persisted, the intervention yielded meaningful gains in psychological well-being and functional capacity.

**Outcome Measures (Case 6)**

Outcome	Pre	Post	Change	% Change
<b>VAS</b>	4	4	0	0%
<b>ODI</b>	23	20	-3	-13.0% ↓
<b>PSS</b>	18	12	-6	-33.3% ↓

**Ayurgenomic Interpretation:**

The participant's Vaatapradhaana Kaphaanubandhi Prakriti explains the differential response. Vaata dominance is linked to heightened pain sensitivity and nervous instability likely sustained pain levels. The Kapha component, associated with emotional stability, supported stress reduction and functional gains. Yoga Chikitsa's calming, grounding practices moderated Vaata-driven psychological reactivity, yielding mental and physical improvements without pain relief.

**CROSS-CASE COMPARATIVE ANALYSIS**

Across the six cases characterized by diverse prakriti constitutions, distinct therapeutic response patterns emerged following a standardized six-week Yoga Chikitsa intervention.

**Pitta-predominant profiles** manifested the most rapid pain attenuation, as evidenced by a 66.7% VAS reduction in Case 4. Functional and psychological enhancements, however, proved inconsistent—robust in the Pitta–Kapha instance but negligible in Pitta–Vaata.

**Kapha-predominant profiles** exhibited the most uniform advancements across domains, encompassing moderate pain relief, substantial functional improvements, and pronounced stress mitigation.

**Vaata-predominant profiles** displayed sustained pain intensity alongside substantial psychological benefits, notably stress reduction. These patterns elucidate prakriti's influence on domain-specific responsiveness, underscoring the merits of Ayurgenomic profiling for individualized yoga therapeutics.

**Table: Summarizing all six cases, including pre- and post-intervention scores and percentage changes across pain (VAS), disability (ODI), and stress (PSS)**

Case	Prakriti	VAS_Pre	VAS_Post	VAS_%Change	ODI_Pre	ODI_Post	ODI_%Change	PSS_Pre	PSS_Post	PSS_%Change
Case 1	Kapha-Pitta	3	2	-33.3	24	14	-41.7	18	10	-44.4
Case 2	Kapha-Vaata	3	2	-33.3	32	22.98	-28.2	18	10	-44.4
Case 3	Pitta-	3	3	0	44.4	28	-36.9	21	13	-38.1

	Kapha									
Case 4	Pitta-Vaata	6	2	-66.7	40	36	-10	24	21	-12.5
Case 5	Vaata-Pitta	3	3	0	28	20	-28.6	26	15	-42.3
Case 6	Vaata-Kapha	4	4	0	23	20	-13	18	12	-33.3

## DISCUSSION

This case series highlights the therapeutic potential of a structured Yoga Therapy protocol in addressing NCLBP, while demonstrating how Ayurgenomic profiling offers meaningful insight into differential treatment responses. Though the intervention was standardized, outcomes varied systematically by prakriti, suggesting that individual constitution significantly modulates therapeutic responsiveness even under uniform treatment conditions.

The 40-minute Yoga Therapy protocol incorporated a progressive sequence of asanas, pranayama, and deep relaxation techniques. Physiologically, asanas enhanced postural stability and spinal mobility, pranayama modulated autonomic function and stress reactivity, and relaxation practices reduced cognitive-emotional arousal. From an Ayurgenomic viewpoint, this multifaceted design resonated differently with the physiological and psychological characteristics of various prakriti types.

- **Kapha-dominant individuals** (Cases 1 & 2) exhibited the most consistent and well-rounded improvement across pain, function, and stress domains. This is consistent with Kapha's stable physiology and emotional grounding, which likely supported adherence, resilience, and steady recovery. The protocol's combination of stimulation (strengthening postures) and regulation (breath and relaxation) suited Kapha's slow but responsive nature.
- **Pitta-dominant profiles** (Cases 3 & 4) demonstrated rapid musculoskeletal improvement, particularly in pain reduction (e.g., 66.7% VAS reduction in Case 4). However, psychological recovery was variable, especially in Pitta-Vaata combinations. This suggests that while physical components matched Pitta's metabolic and structural efficiency, further emotional modulation strategies may be needed for full-spectrum recovery.
- **Vaata-dominant participants** (Cases 5 & 6) showed excellent stress reduction (up to 42.3%) but limited or no pain relief. Vaata's known traits—sensory amplification, instability, and poor healing—may have blunted somatic responsiveness, even as pranayama and relaxation calmed psychological reactivity. The protocol was partially effective, addressing emotional dysregulation but not deeper neuromuscular pain mechanisms.

These observations align with classical Ayurvedic characterizations of the doshas. Kapha, characterized by stability and cohesion, demonstrated the most comprehensive responses overall. [14–16] Pitta, defined by intensity and inflammatory tendencies, exhibited rapid yet heterogeneous improvements.[17] Vata, associated with variability and sensitivity, showed circumscribed benefits particularly in stress reduction, but not in pain alleviation.[18]

### 5.2 Clinical Implications and Comparison with Literature

The findings align with existing research demonstrating yoga's efficacy in reducing pain and stress in chronic back pain populations. However, most prior studies adopt a one-size-fits-all model rooted in the Western biopsychosocial framework. This case series expands current understanding by integrating prakriti-based Ayurgenomics, showing that constitution type influences both the magnitude and domain-specific pattern of response.

#### Such insight can inform dosha-specific yoga prescriptions:

- Kapha may benefit most from dynamic stimulation followed by grounding.
- Pitta may need greater emotional regulation alongside physical practices.
- Vaata may require prolonged or deeper stabilizing interventions for somatic outcomes.

### 5.3 Strengths and Limitations

#### Strengths:

- Use of validated outcome measures (VAS, ODI, PSS)
- Integration of Ayurgenomics for personalized interpretation
- Standardized protocol enabling cross-case comparison

#### Limitations:

- Small sample size (inherent to case-series design)
- No control group
- Prakriti assessment, though standardized via AyuSoft, retains subjective limitations

#### Conclusion

Although the Yoga Therapy protocol yielded benefits across all prakriti types, Kapha-dominant participants exhibited the most comprehensive therapeutic improvements. Pitta-dominant individuals demonstrated predominant somatic gains, whereas Vaata-

dominant ones primarily benefited psychologically. These observations endorse integrating Ayurgenomic profiling into yoga therapy design to enable more precise, constitution-tailored interventions.

### Acknowledgement

The authors gratefully acknowledge the **Institute of Salutogenesis and Complementary Medicine (ISCM)** and the **Department of Orthopaedics, Mahatma Gandhi Medical College and Research Institute (MGMCRI), Sri Balaji Vidyapeeth**, for their support, clinical cooperation, and assistance in conducting this case series on chronic low back pain. The team extends sincere thanks to the experts who previously developed and standardized the *Yoga Therapy Protocol for Chronic Low Back Pain*, namely **Dr Ananda Balayogi Bhavanani, Dr. Meena Ramanathan, Dr. Arpan Bhatt, Dr. Vandana Srivastava, Dr. Rajarajan Dhanasekaran** and **Dr. J. Mohanakrishnan** whose work enabled the use of an established and evidence informed program in the present study. Their contributions in the fields of yoga therapy, Ayurveda, physiotherapy, neurosurgery, and orthopaedics provided essential foundations that strengthened the clinical relevance of this case series. The authors also acknowledge the academic guidance and encouragement offered by **Dr. Ganesan Dayanidy** and **Dr. Rajasekaran Balaji** from the School of Yoga Therapy (SYT), ISCM, whose insights supported the scholarly interpretation and presentation of this work.

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