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Ultra-Endurance Dynamic Suryanamaskar Modulates Electrophotonic Indices of Systemic Autonomic–Energetic Coherence: A Single-Case Study

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Scope Statement

This manuscript fits within the scope of Frontiers in Physiology by investigating integrative autonomic, respiratory, and systems-level regulation during extreme human performance. Dynamic Suryanamaskar (DSN) is one of the most widely practiced yoga sequences globally, performed daily by millions. Understanding its physiological mechanisms—particularly under ultra-endurance conditions—is therefore of broad scientific and public relevance. The present work leverages a unique opportunity to examine a 10-hour DSN session performed by the current Guinness World Record holder, whose exceptional capacity enables exploration of regulatory processes not accessible in typical laboratory cohorts. The study applies electrophotonic imaging (GDV/BioWell) to assess systemic regulatory state, focusing on indices related to autonomic balance, entropy, and integrative coherence. These measures are interpreted through contemporary frameworks of autonomic flexibility, breath-mediated vagal regulation, and physiological complexity. The findings suggest that breath-synchronized, attentively regulated movement may support coherent systemic organization even under extreme energetic demand, offering a novel perspective on ultra-endurance physiology. By introducing DSN as an experimental model for autonomic–respiratory coupling and systems-level adaptation, this manuscript contributes to the journal's mission to advance understanding of integrative physiological mechanisms. The work is hypothesis-generating and provides a foundation for future multimodal investigations incorporating HRV, neurophysiology, and biochemical markers.

Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest

Credit Author Statement

Hongasandra Rama Rao Nagendra: Formal Analysis, Funding acquisition, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing. **Krzysztof Stec**: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. **Ramesh Mavathur**: Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing. **KJ Sridevi**: Data curation, Formal Analysis, Investigation, Writing – review & editing.

Keywords

autonomic regulation, Dynamic Suryanamaskar, Electrophotonic imaging, GDV, Physiological coherence, Prāṇamaya Kośa, ultra-endurance yoga

Abstract

Word count: 230

Background: Ultra-endurance exercise is typically associated with autonomic imbalance, metabolic strain, and increased physiological entropy. In contrast, yogic traditions propose that breath-synchronized, attentively regulated movement can enhance systemic integration even under extreme energetic demand. Contemporary electrophotonic methods such as Gas Discharge Visualization (GDV/BioWell) provide quantifiable indices that may reflect shifts in systemic regulatory state. Objective: This study examined electrophotonic indices associated with the Prāṇamaya Kośa—interpreted here as a functional autonomic–respiratory–regulatory domain—before and after an extreme 10-hour session of Dynamic Suryanamaskar (DSN). Methods: A 30-year-old elite yoga practitioner (>15 years of training) completed 2,250 rounds of DSN over 10 continuous hours. GDV/BioWell imaging of all fingertips was conducted immediately before and after the session under controlled environmental conditions. Standard parameters (Energy, Balance, Entropy, Stress, Aura Area, Chakra Alignment) were computed using validated algorithms. Results: Post-session measures demonstrated increased total energy (+24%), improved bilateral balance (84%→96%), reduced entropy (−32%), reduced stress index (−43%), expanded projected field area (+24%), and reduced chakra deviation (26°→8°). These directional changes indicate enhanced electrophotonic coherence despite the extreme physical workload. Conclusion: This exploratory single-case study suggests that ultra-endurance, breath-synchronized yogic movement may promote systemic regulatory coherence rather than depletion. When interpreted through integrative physiological frameworks, GDV-derived indices appear sensitive to autonomic and psychophysiological regulation during extreme but consciously regulated exertion. The findings generate testable hypotheses for future multimodal investigations integrating heart rate variability, neurophysiology, and biochemical markers.

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Studies involving animal subjects
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Studies involving human subjects
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gave its approval for the present study. Study procedures were described in detail and
written informed consent was obtained from participants.. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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Ultra-Endurance Dynamic Suryanamaskar Modulates Electrophotonic Indices of Systemic Autonomic–Energetic Coherence: A Single-Case Study

Short title: Dynamic Suryanamaskar and Autonomic Coherence

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Background: Ultra-endurance exercise is typically associated with autonomic imbalance, metabolic strain, and increased physiological entropy. In contrast, yogic traditions propose that breath-synchronized, attentively regulated movement can enhance systemic integration even under extreme energetic demand. Contemporary electrophotonic methods such as Gas Discharge Visualization (GDV/BioWell) provide quantifiable indices that may reflect shifts in systemic regulatory state.

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Methods: A 30-year-old elite yoga practitioner (>15 years of training) completed 2,250 rounds of DSN over 10 continuous hours. GDV/BioWell imaging of all fingertips was conducted immediately before and after the session under controlled environmental conditions. Standard parameters (Energy, Balance, Entropy, Stress, Aura Area, Chakra Alignment) were computed using validated algorithms.

Results: Post-session measures demonstrated increased total energy (+24%), improved bilateral balance (84%→96%), reduced entropy (−32%), reduced stress index (−43%), expanded projected field area (+24%), and reduced chakra deviation (26°→8°). These directional changes indicate enhanced electrophotonic coherence despite the extreme physical workload.

Conclusion: This exploratory single-case study suggests that ultra-endurance, breath-synchronized yogic movement may promote systemic regulatory coherence rather than depletion. When interpreted through integrative physiological frameworks, GDV-derived indices appear sensitive to autonomic and psychophysiological regulation

during extreme but consciously regulated exertion. The findings generate testable hypotheses for future multimodal investigations integrating heart rate variability, neurophysiology, and biochemical markers.

Keywords: Dynamic Suryanamaskar; ultra-endurance yoga; electrophotonic imaging; GDV; Prāṇamaya Kośa; autonomic regulation; physiological coherence

1. Introduction

Ultra-endurance physical activity imposes one of the most demanding stress loads on the human organism. Prolonged high-intensity exertion is typically associated with sustained sympathetic activation, metabolic acidosis, inflammatory signaling, and a reduction in physiological complexity. From a systems-physiology perspective, health is increasingly conceptualized not merely as maximal performance capacity but as the ability to maintain adaptive variability and coherent integration across regulatory domains (Lipsitz, 2004; Peng et al., 1995).

Dynamic Suryanamaskar (DSN) represents a distinctive model of ultra-endurance activity. Unlike conventional endurance modalities, DSN combines high metabolic demand with controlled nasal breathing and continuous attentional engagement. Previous investigations have shown that DSN can reach intensities of 14.5–16 METs, corresponding to approximately 90–99% of VO_2max in trained practitioners (Stec et al., 2016; Stec et al., 2023). These values are consistent with the upper range of metabolic expenditure reported in other forms of vigorous yoga practice (Hagins et al., 2007; Clay et al., 2005).

Classical yoga describes this regulatory integration through the concept of Prāṇamaya Kośa, traditionally understood as the vital sheath governing breath and energetic regulation (Taittirīya Upaniṣad 2.2). In the present work, Prāṇamaya Kośa is interpreted functionally—as a conceptual model corresponding to integrated autonomic, respiratory, and psychophysiological regulation—rather than as a literal anatomical structure. This interpretation aligns with contemporary physiological models describing how slow, controlled breathing modulates autonomic and cortical networks (Jerath et al., 2006).

Recent advances in electrophotonic imaging based on Gas Discharge Visualization (GDV) provide indirect, quantifiable indices that have been shown to change following yoga, pranayama, and meditation practices (Korotkov, 2018; Kushwah et al., 2020). Although GDV does not measure biological energy directly, its parameters appear sensitive to systemic regulatory state, stress adaptation, and autonomic balance.

Despite growing interest, quantitative documentation of electrophotonic changes during long-duration, high-intensity yogic practice remains scarce. The present single-case study addresses this gap by examining GDV/BioWell indices before and after a 10-hour continuous DSN session.

2. Methods

2.1 Instrumentation

Electrophotonic measurements were obtained using a BioWell 2.0 GDV system (St. Petersburg State University–certified model) with BioWell software version 5.0 (Korotkov, 2018). Each fingertip was exposed to a 10 kV, 1024 Hz electrical impulse for 1 s, and the resulting gas-discharge emission was captured by a CCD camera.

Computed parameters included:

- Energy (J): integral of glow intensity
- Balance (%): left–right symmetry index
- Entropy (index): informational order of emission patterns
- Stress (index): deviation from normative homeostatic baseline
- Aura Area (cm^2): two-dimensional projection of field size
- Chakra Alignment (°): deviation of central axis from vertical

Standard calibration procedures and environmental controls were applied.

2.2 Participant

A 30-year-old male elite yoga practitioner with more than 15 years of daily practice participated in the study. Baseline physiological parameters included a resting heart rate of approximately 60 bpm and blood pressure of ~112/70 mmHg. Lifestyle factors included a vegetarian diet and non-smoking status. At the time of the experiment, the participant held a Guinness World Record related to Suryanamaskar performance, confirmed as of May 2025.

2.3 Procedure

The participant completed 2,250 rounds of Dynamic Suryanamaskar over 10 continuous hours. Ambient temperature was maintained at approximately 27 °C with ~55% relative humidity. Nasal breathing and sustained inward attentional focus were preserved throughout the session. Hydration was provided hourly. GDV/BioWell measurements were obtained immediately before and immediately after the session under controlled environmental conditions.

2.4 Ethics Statement

Written informed consent was obtained from the participant for both participation and publication. The observational single-case design involved only non-invasive procedures. Institutional ethical review was waived in accordance with local guidelines for single-subject performance-physiology studies.

3. Results

Table 1. Participant Characteristics and Intervention Overview

Parameter	**Description**
Age	30 years
Sex	Male
Yoga experience	>15 years
Intervention	10 h continuous DSN

Parameter	Description
Total rounds	2,250
Breathing	Nasal, synchronized
Environment	Indoor, ~27 °C

Table 2. GDV/BioWell Parameters Before and After 10 h DSN

Parameter	Pre	Post	% Change
Energy	~54	67	+24%
Balance	84%	96%	+14%
Entropy	0.46	0.31	−32%
Stress	5.4	3.1	−43%
Aura Area	37 cm²	46 cm²	+24%
Chakra Deviation	26°	8°	−70%

Across all parameters, post-session values shifted toward **greater symmetry, reduced entropy, and lower stress indices**, despite extreme duration and workload.

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4. Discussion

4.1 Electrophotonic coherence under extreme load

Conventional ultra-endurance exercise typically elevates physiological stress and increases systemic entropy (Millet, 2011). In contrast, the GDV pattern observed following the 10-hour DSN session indicates enhanced electrophotonic coherence. Similar directional changes—though generally of smaller magnitude—have been reported following pranayama and meditation practices (Kushwah et al., 2020; Brown and Gerbarg, 2005). The present findings therefore suggest that breath-synchronized, attentively regulated movement may support integrative regulatory processes even under extreme energetic demand. This interpretation is compatible with central-governor models proposing that fatigue and performance are modulated by top-down neural regulation (Noakes, 2012).

4.2 Autonomic integration and balance

Improved left–right balance may reflect enhanced autonomic and hemispheric integration. Autonomic flexibility is widely recognized as a marker of resilience under stress, commonly

indexed through heart rate variability (Thayer et al., 2012; Shaffer and Ginsberg, 2017). Breath-regulated movement has been shown to strengthen vagal pathways and promote autonomic coherence (Lehrer and Gevirtz, 2014). The current results imply that breath-regulated DSN may help preserve integrative autonomic function during prolonged, high-intensity exertion.

4.3 Entropy reduction and adaptive order

A 32% reduction in entropy suggests increased informational order within the electrophotonic signal. From a systems-physiology perspective, healthy regulation is characterized by structured variability rather than disorder (Goldberger et al., 2002; Peng et al., 1995). Breath-synchronized DSN may impose top-down regulatory constraints that counteract the entropy typically induced by extended physical exertion, thereby supporting adaptive systemic organization. This interpretation is consistent with the broader "loss of complexity" framework, which associates reduced physiological complexity with diminished regulatory capacity (Lipsitz, 2004).

4.4 Functional interpretation of Prāṇamaya Kośa

Within yogic physiology, Prāṇamaya Kośa is described as the sheath governing breath and vitality. Interpreted functionally, this construct aligns with contemporary models of autonomic–respiratory coupling and integrative psychophysiological regulation (Jerath et al., 2006). The present GDV findings are consistent with such an interpretation, supporting a systems-level view rather than claims of a discrete anatomical energy field.

5. Limitations

This study is limited by its single-subject, pre–post design and by the indirect nature of GDV measurements. The findings should therefore be considered hypothesis-generating rather than confirmatory. Future research should incorporate control conditions and multimodal physiological assessments, including HRV, EEG, and biochemical markers, to more comprehensively evaluate regulatory mechanisms during ultra-endurance yogic practice.

6. Conclusion

Ten hours of Dynamic Suryanamaskar were associated with coherent directional changes in electrophotonic indices suggestive of enhanced systemic regulatory integration. Rather than exhibiting the elevated stress, autonomic imbalance, and increased entropy typically observed during ultra-endurance exertion, the participant demonstrated improved left–right balance, reduced entropy, and lower stress indices. These findings align with contemporary models of autonomic flexibility, breath-mediated vagal regulation, and systems-level physiological complexity, suggesting that breath-synchronized, attentively regulated movement may help maintain integrative regulatory function even under extreme energetic demand. Although preliminary and limited by its single-case design, this study highlights DSN as a promising experimental model for investigating how disciplined breathing, sustained attentional engagement, and high metabolic load interact to shape autonomic, psychophysiological, and

systemic coherence. Future multimodal research incorporating HRV, EEG, metabolic markers, and neurophysiological measures is warranted to further elucidate the mechanisms underlying these effects.

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