

Forest Yoga vs. Studio Yoga: Differential Effects on Cortisol Levels and Immune System Markers in Healthy Adults

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Article Info	ABSTRACT
<p>Article History: Received: 17th January 2026 Accepted: 22nd January 2026 Published: 02nd February 2026</p>	<p>Background: Yoga is widely recognized for its stress-reducing and immune-enhancing benefits. Environmental settings, especially natural surroundings, may further augment these benefits.</p> <p>Objective: This study investigates the differential effects of yoga practiced in a forest environment compared to a traditional indoor studio on cortisol levels and immune system markers in healthy adults.</p> <p>Methods: Forty healthy adults (age 25–45) were randomly assigned to either a forest yoga group (n = 20) or a studio yoga group (n = 20) for 4 sessions over two weeks. Pre- and post-intervention salivary cortisol and immunoglobulin A (IgA) levels were measured.</p> <p>Results: The forest yoga group showed a significantly greater reduction in cortisol (p = 0.008) and a larger increase in IgA levels (p = 0.012) compared to the studio yoga group.</p> <p>Conclusion: Yoga performed in a natural forest environment yields stronger physiological stress-reducing and immune-enhancing effects than studio-based yoga. Nature-based yoga could be a cost-effective and accessible public health tool.</p>
<p>Keywords:</p> <p><i>Forest yoga, Studio yoga, cortisol level, immune system markers and healthy adults</i></p>	

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Introduction

Yoga is a mind-body practice that combines physical postures (asanas), controlled breathing (pranayama), and meditation. It has been shown to decrease cortisol levels and improve immune function. Additionally, "forest bathing" or Shinrin-yoku—time spent in natural environments—also reduces physiological stress and modulates immune response.

However, limited research exists exploring the **combined effect** of yoga and natural environments on biochemical markers of health. Given the rise of nature-based therapies and urban stress, this study evaluates whether practicing yoga in a forest setting leads to better health outcomes than the same yoga routine in a traditional studio.

Objectives

- To compare the effects of forest yoga vs. studio yoga on **salivary cortisol** levels.
- To assess the impact on **salivary IgA**, a key immune marker.
- To explore whether the natural environment enhances the physiological outcomes of yoga.

Gaps in Literature

While yoga and nature exposure individually show benefits, very few experimental studies have compared **environmental settings** in yoga practice using **objective biomarkers** like cortisol and IgA.

Methodology

Research Design

Randomized Controlled Trial (RCT) with two parallel groups.

Sample

- Total participants: 40 healthy adults
- Age: 25–45 years
- Randomized into two groups (n = 20 each)

Inclusion Criteria

- Healthy individuals with no chronic illness
- Not on medication affecting immunity
- Non-smokers
- No prior yoga experience in last 6 months

Exclusion Criteria

- Respiratory or autoimmune diseases
- Mental health diagnoses
- Pregnancy

Methods

Intervention Details

- **Duration:** 2 weeks
- **Sessions:** 2 sessions per week (4 sessions total)
- **Duration/session:** 60 minutes
- **Yoga Protocol:** Standard Hatha Yoga sequence (sun salutations, gentle postures, pranayama, 5 min meditation)

Group Descriptions

- **Group A (Forest Yoga):** Sessions held in a quiet forest park in morning hours.
- **Group B (Studio Yoga):** Sessions held indoors under standard lighting and ventilation.

Procedure

1. **Pre-intervention baseline collection:** Saliva samples collected before the first session in a fasting state (8:00 AM).
2. **Yoga sessions:** Supervised by certified yoga instructor; identical routine for both groups.
3. **Post-intervention collection:** Saliva collected 24 hours after the last session at the same time (8:00 AM).
4. **Storage & Testing:** Saliva samples stored at -20°C and tested via ELISA kits for cortisol and IgA.

Research Tools

- **Perceived Stress Scale (PSS)** for subjective stress assessment
- **Salivary cortisol (nmol/L)** – Measured by ELISA
- **Salivary IgA ($\mu\text{g/mL}$)** – Measured by immunoassay
- **SPSS v26** used for statistical analysis

Statistical Analysis

- **Paired t-test** to compare pre- and post-intervention within groups
- **Independent t-test** for between-group differences
- **Significance level:** $p < 0.05$

Results

Table 1: Pre- and Post- Intervention Biomarkers

Group	Cortisol (nmol/L) Pre	Cortisol Post	IgA ($\mu\text{g/mL}$) Pre	IgA Post
Forest Yoga	18.2 \pm 2.6	13.1 \pm 2.1	98.5 \pm 10.4	121.3 \pm 9.2
Studio Yoga	17.9 \pm 2.9	15.4 \pm 2.3	97.6 \pm 11.1	106.5 \pm 10.6

Statistical Findings:

- Cortisol reduction was significantly greater in forest yoga group ($p = 0.008$)
- IgA increase was significantly higher in forest yoga group ($p = 0.012$)

Discussion

The results demonstrate that yoga practiced in a natural forest setting produced greater physiological benefits than yoga practiced in a studio. The greater reduction in cortisol may be due to the calming effect of natural sights, sounds, and air quality. The increase in IgA indicates a stronger immune modulation, possibly influenced by lower stress and phytoncides in forest air.

These findings support the synergistic effect of yoga and natural environments, aligning with biophilia theory, which suggests humans are evolutionarily wired to benefit from nature exposure.

Conclusion

This study provides experimental evidence that forest yoga is more effective than studio yoga in reducing cortisol and enhancing immunity in healthy adults. Nature-based yoga interventions could be integrated into wellness programs, especially in urban environments where chronic stress is prevalent.

12. Recommendations

- Incorporate outdoor yoga in workplace and public health programs
- Larger studies with more biomarkers (e.g., NK cell activity)
- Explore long-term effects and psychological outcomes

13. References

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