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A Comparative Analysis of Yoga Practice and Psychophysiological Balance in Digital Lifestyles

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Abstract— Prolonged engagement with digital devices has produced a distinct occupational profile characterised by sympathetic overactivation, fragmented sleep and elevated perceived stress. This study examines whether structured yoga practice restores psychophysiological balance more effectively than conventional physical exercise among adults with high daily screen exposure. A twelve-week, three-arm quasi-experimental study was conducted with 180 knowledge workers reporting more than eight hours of daily screen time. Participants were allocated to an integrated yoga group, a moderate aerobic exercise group, or a no-intervention control group. Outcomes included perceived stress, sleep quality, anxiety, problematic smartphone use, short-term heart rate variability indices, resting heart rate and morning salivary cortisol. Repeated-measures analysis of variance showed significant group-by-time interactions across all primary outcomes, with the yoga group recording the largest gains in vagally mediated heart rate variability and the largest reductions in perceived stress and cortisol. Change in parasympathetic tone was inversely associated with change in perceived stress, supporting an autonomic pathway of benefit. The findings indicate that yoga's combination of slow breathing, postural work and attentional training addresses digital-lifestyle strain more comprehensively than exercise alone.

Keywords— yoga, heart rate variability, digital lifestyle, perceived stress, autonomic balance, screen time

INTRODUCTION

The distribution of human attention has shifted decisively toward screens over the past decade, and with it the physiological demands placed on the autonomic nervous system. Knowledge work now routinely involves eight to twelve hours of continuous visual and cognitive engagement with digital interfaces, punctuated by notification-driven task switching and extended into the pre-sleep window. This pattern is associated with shortened sleep, delayed circadian phase, reduced physical movement and a sustained low-grade activation of the sympathetic branch of the autonomic nervous system.

The concept of psychophysiological balance refers to the flexible reciprocity between sympathetic and parasympathetic activity that allows an organism to mobilise resources under demand and recover efficiently afterwards. Loss of this

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flexibility, expressed most sensitively as reduced heart rate variability, is a recognised marker of chronic strain. Digital lifestyles compress recovery windows, and the physiological signature that results is not acute pathology but a slow erosion of restorative capacity.

Yoga occupies an unusual position among candidate interventions because it operates simultaneously on respiratory, muscular and attentional channels. Slow, regulated breathing directly modulates baroreflex sensitivity and vagal outflow; sustained postures alter proprioceptive and muscular tone; meditative components reduce ruminative cognitive load. Conventional aerobic exercise, by contrast, improves cardiovascular fitness and mood but does not explicitly train respiratory regulation or attentional stability. Whether these differences translate into measurably different psychophysiological outcomes in a digitally saturated population remains insufficiently examined.

This study therefore compares an integrated yoga protocol against a matched aerobic exercise protocol and a passive control condition, using both self-reported and physiological indicators, in adults whose occupations require heavy screen use.

Review of Literature

Evidence for yoga's effect on affective and physiological outcomes has accumulated steadily. Streeter and colleagues demonstrated in a randomised study using magnetic resonance spectroscopy that a yoga intervention produced greater increases in thalamic GABA levels and greater mood improvement than a metabolically matched walking condition, establishing an early neurochemical basis for differential benefit. Cramer and colleagues, in a meta-analysis of randomised controlled trials, found moderate short-term reductions in depressive symptoms relative to usual care, though heterogeneity across protocols was substantial.

Physiological pathways have received parallel attention. Pascoe, Thompson and Ski conducted a meta-analysis of yoga and mindfulness-based stress reduction across stress-related physiological measures and reported reductions in resting cortisol, blood pressure and heart rate. Tyagi and Cohen reviewed the yoga and heart rate variability literature and concluded that most studies report increased vagal tone following practice, while noting inconsistency in measurement windows and metrics. Telles, Sharma and Balkrishna examined alternate nostril breathing specifically and observed altered blood pressure and variability profiles relative to breath awareness alone, indicating that respiratory technique itself carries autonomic consequences.

The theoretical justification for using heart rate variability as an outcome rests on work by Thayer and colleagues, whose meta-analysis of neuroimaging and variability studies linked vagally mediated indices to prefrontal inhibitory control over subcortical threat circuitry. Shaffer and Ginsberg provided normative reference values and metric definitions that permit comparison across studies, while the Task Force standards established the measurement conventions still in general use. Zaccaro and colleagues systematically reviewed slow breathing research and identified consistent shifts toward parasympathetic dominance and increased alpha activity, and Lehrer and Gevirtz described the resonance-frequency mechanism through which paced breathing amplifies baroreflex gain.

Mechanistic accounts specific to yoga have been advanced by Gard and colleagues, who proposed a self-regulatory framework encompassing autonomic, attentional and affective components, and by Riley and Park, whose systematic review of mediating mechanisms identified reduced stress reactivity and increased mindfulness as the most consistently supported pathways. Gothe and McAuley additionally documented cognitive benefits across acute and chronic yoga exposure, and Chu and colleagues established cardiometabolic risk reduction in a meta-analysis of randomised trials.

On the exposure side, Elhai and colleagues reviewed the relationship between problematic smartphone use and anxiety and depression, finding consistent positive associations of small to moderate magnitude. Christensen and colleagues used objectively measured screen time rather than self-report and

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found associations with poorer sleep efficiency and later sleep onset. Twenge and Campbell, analysing population-level data, reported lower psychological wellbeing among heavy screen users, with the association strengthening beyond moderate daily exposure.

Instrumentation for the present study draws on established scales: the Perceived Stress Scale developed by Cohen, Kamarck and Mermelstein; the Pittsburgh Sleep Quality Index of Buysse and colleagues; the Depression Anxiety Stress Scales of Lovibond and Lovibond; and the short-form Smartphone Addiction Scale validated by Kwon and colleagues.

The literature thus establishes that yoga improves affective and autonomic outcomes, and separately that heavy digital exposure degrades them. What remains scarce is direct comparative work in which digitally overexposed adults are the defined population and in which yoga is contrasted against an activity-matched alternative using simultaneous psychological and autonomic measurement.

Research Gap and Objectives

Three gaps motivate this work. First, most yoga trials recruit clinical or general community samples rather than populations defined by digital exposure. Second, active comparators are frequently absent, leaving open whether benefits reflect yoga specifically or physical activity generally. Third, psychological and physiological outcomes are seldom modelled together, preventing inference about mediating pathways.

The objectives were accordingly to compare changes in perceived stress, sleep quality, anxiety and problematic smartphone use across yoga, exercise and control conditions; to compare changes in autonomic and endocrine indicators across the same conditions; and to examine whether change in parasympathetic tone accounts for change in perceived stress.

Hypotheses

The study tested three hypotheses. The first held that the yoga group would show significantly greater improvement in psychological outcomes than both comparison groups. The second held that the yoga group would show significantly greater improvement in vagally mediated heart rate variability and greater cortisol reduction than both comparison groups. The third held that individual change in parasympathetic tone would be inversely associated with change in perceived stress across the whole sample.

Methodology

A three-arm, pre-post quasi-experimental design was employed over twelve weeks. Participants were recruited from information technology, financial services and academic institutions through workplace notices. Eligibility required an age between 22 and 45 years, self-reported screen exposure of at least eight hours daily on working days, no current yoga or structured exercise practice, and no diagnosed cardiovascular, endocrine or psychiatric condition. Participants on beta-blockers, antidepressants or corticosteroids were excluded because of direct effects on the outcome measures.

Allocation followed workplace clusters to prevent contamination between conditions, with cluster assignment determined by a computer-generated sequence. A total of 180 participants entered the study, 60 per arm. Sample size was determined a priori for a repeated-measures analysis of variance with three groups and two measurement occasions, assuming a medium effect of $f = 0.25$, alpha of 0.05, power of 0.90 and a within-subject correlation of 0.50, yielding a minimum requirement of 66 participants; the larger recruited sample allowed for attrition and subgroup analysis.

The yoga arm practised a supervised integrated protocol five days weekly for sixty minutes, comprising ten minutes of joint loosening, twenty-five minutes of asana, fifteen minutes of pranayama including nadi shodhana and bhramari at approximately six breaths per minute, and ten minutes of guided relaxation. The exercise arm performed supervised moderate-intensity treadmill and cycle ergometer work five days weekly for sixty minutes at 60–70 percent of age-predicted maximum heart rate, matched for session frequency, duration and instructor contact. The control arm continued routine activity and received the yoga protocol after the study concluded.

Assessments were conducted at baseline and at week twelve, between 07:00 and 09:00 following overnight fasting, at least twenty-four hours after the last session. Short-term heart rate variability was recorded for five minutes in supine rest after ten minutes of acclimatisation using a chest-strap electrocardiographic sensor sampling at 1000 Hz, with artefact correction applied before computing RMSSD, SDNN and the LF/HF ratio according to established standards. Salivary samples for cortisol were collected thirty minutes after waking and analysed by enzyme-linked immunosorbent assay. Psychological outcomes were assessed using the Perceived Stress Scale, the Pittsburgh Sleep Quality Index, the anxiety subscale of the Depression Anxiety Stress Scales, and the short-

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form Smartphone Addiction Scale. Daily screen time was extracted from device-native usage logs averaged across the preceding seven days.

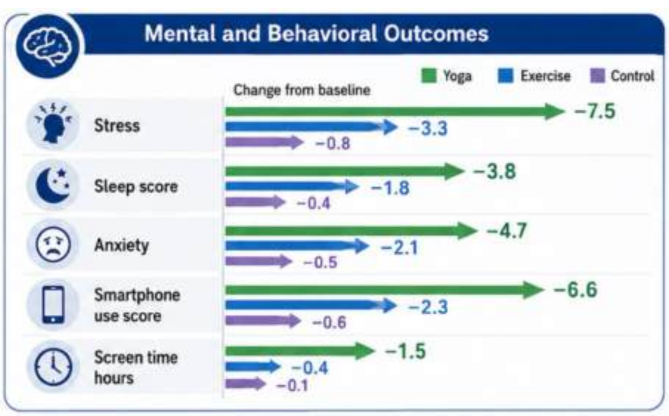
Analysis used mixed-model repeated-measures analysis of variance with group as between-subject factor and time as within-subject factor, with the group-by-time interaction as the term of interest. Partial eta squared quantified effect magnitude. Bonferroni-corrected pairwise comparisons followed significant interactions. Pearson correlations and hierarchical linear regression examined associations among change scores. Analysis followed intention-to-treat principles with multiple imputation for missing values, and significance was set at 0.05.

RESULTS

Twelve participants withdrew, giving an attrition rate of 6.7 percent and an analysed sample of 168. Baseline characteristics did not differ significantly across arms.

Table 1. Baseline characteristics by group

Characteristic	Yoga (n = 56)	Exercise (n = 55)	Control (n = 57)	p
Age (years)	31.6 ± 5.7	31.2 ± 6.0	31.4 ± 5.8	0.94
Female (%)	46.4	45.5	47.4	0.98
Body mass index (kg/m²)	25.1 ± 3.2	24.8 ± 3.4	25.3 ± 3.1	0.72
Daily screen time (h)	9.7 ± 1.4	9.5 ± 1.5	9.6 ± 1.3	0.81
Work experience (years)	7.8 ± 4.1	7.5 ± 4.3	7.9 ± 4.0	0.86



Session adherence averaged 87.4 percent in the yoga arm and 84.9 percent in the exercise arm, a non-significant difference.

Table 2. Psychological outcomes before and after intervention

Measure	Group	Pre	Post	Change	F(2,165)	ηp²
Perceived Stress Scale	Yoga	24.8 ± 4.6	17.3 ± 4.1	−7.5	38.42	0.318
	Exercise	24.5 ± 4.9	21.2 ± 4.4	−3.3		
	Control	24.9 ± 4.7	24.1 ± 4.8	−0.8		
Pittsburgh Sleep Quality Index	Yoga	9.6 ± 2.7	5.8 ± 2.1	−3.8	29.76	0.265
	Exercise	9.4 ± 2.9	7.6 ± 2.4	−1.8		
	Control	9.7 ± 2.8	9.3 ± 2.7	−0.4		
DASS anxiety subscale	Yoga	11.8 ± 3.9	7.1 ± 3.2	−4.7	31.08	0.274
	Exercise	11.5 ± 4.1	9.4 ± 3.6	−2.1		
	Control	11.9 ± 3.8	11.4 ± 3.9	−0.5		
Smartphone Addiction Scale	Yoga	34.2 ± 7.1	27.6 ± 6.5	−6.6	22.15	0.212
	Exercise	33.8 ± 7.4	31.5 ± 6.9	−2.3		
	Control	34.5 ± 7.2	33.9 ± 7.0	−0.6		
Daily screen time (h)	Yoga	9.7 ± 1.4	8.2 ± 1.3	−1.5	16.73	0.169

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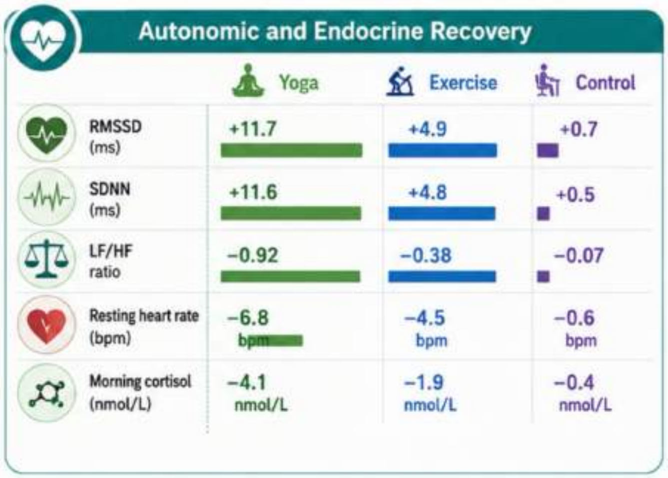
	Exercise	9.5 ± 1.5	9.1 ± 1.4	−0.4		
	Control	9.6 ± 1.3	9.5 ± 1.4	−0.1		



All group-by-time interactions were significant at $p < 0.001$. Post-hoc comparisons placed the yoga arm significantly ahead of the exercise arm on perceived stress, sleep quality, anxiety and smartphone use, and both active arms significantly ahead of control on every psychological measure except screen time, where the exercise arm did not differ from control.

Table 3. Autonomic and endocrine outcomes before and after intervention

Measure	**Group**	**Pre**	**Post**	**Change**	**$F(2,165)$**	**ηp^2**
RMSSD (ms)	Yoga	32.4 ± 9.8	44.1 ± 11.2	+11.7	34.61	0.296
	Exercise	33.1 ± 10.2	38.0 ± 10.6	+4.9		
	Control	32.8 ± 9.6	33.5 ± 9.9	+0.7		
SDNN (ms)	Yoga	41.6 ± 11.4	53.2 ± 12.7	+11.6	27.94	0.253
	Exercise	42.3 ± 11.9	47.1 ± 12.1	+4.8		
	Control	41.9 ± 11.2	42.4 ± 11.5	+0.5		
LF/HF ratio	Yoga	2.84 ± 0.71	1.92 ± 0.58	−0.92	25.37	0.235
	Exercise	2.79 ± 0.74	2.41 ± 0.66	−0.38		
	Control	2.86 ± 0.69	2.79 ± 0.72	−0.07		
Resting heart rate (bpm)	Yoga	78.4 ± 7.9	71.6 ± 7.1	−6.8	19.82	0.194
	Exercise	77.9 ± 8.2	73.4 ± 7.6	−4.5		
	Control	78.6 ± 8.0	78.0 ± 7.8	−0.6		
Salivary cortisol (nmol/L)	Yoga	14.2 ± 3.6	10.1 ± 3.0	−4.1	23.46	0.221
	Exercise	13.9 ± 3.8	12.0 ± 3.4	−1.9		
	Control	14.3 ± 3.5	13.9 ± 3.6	−0.4		

The yoga arm exceeded the exercise arm on every autonomic and endocrine measure. Resting heart rate showed the smallest between-group separation, consistent with aerobic training producing chronotropic benefit through a mechanism largely independent of vagal modulation.

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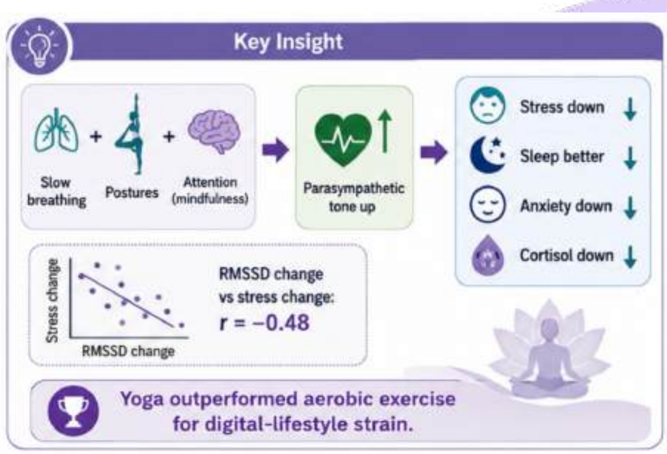
Across the pooled sample, change in RMSSD correlated inversely with change in perceived stress ($r = -0.48$, $p < 0.001$) and with change in the anxiety subscale ($r = -0.42$, $p < 0.001$). Reduction in screen time correlated with improvement in sleep quality ($r = 0.34$, $p < 0.001$). Within the yoga arm, session adherence correlated with stress reduction ($r = -0.41$, $p = 0.002$).

A hierarchical regression predicting change in perceived stress from group assignment, change in RMSSD, change in screen time and baseline stress explained 42 percent of variance, $F(4,163) = 29.51$, $p < 0.001$. Standardised coefficients were −0.36 for yoga group membership, −0.31 for change in RMSSD, 0.19 for change in screen time and −0.14 for baseline stress, all significant at $p < 0.05$. Entry of change in RMSSD reduced the group coefficient from −0.49 to −0.36, indicating partial mediation through autonomic pathways.



Discussion

The results support all three hypotheses. Yoga produced larger improvements than activity-matched aerobic exercise across psychological, autonomic and endocrine domains, and the advantage was widest precisely where the interventions differ most: parasympathetic tone and sympathovagal balance. The near-doubling of the RMSSD advantage over exercise, alongside a substantially larger LF/HF reduction, points to the pranayama component as the probable active ingredient. Slow breathing at approximately six cycles per minute approaches the cardiovascular resonance frequency, amplifying baroreflex gain in a way that continuous aerobic work does not, a mechanism consistent with prior accounts of paced breathing and with reviews of slow-breathing physiology.

The comparatively narrow gap in resting heart rate is informative rather than anomalous. Aerobic training lowers heart rate largely through structural cardiac adaptation and plasma volume expansion, whereas the yoga arm's larger reduction accompanied by markedly higher variability suggests an additional vagal contribution. Two different routes converged on partially overlapping outcomes.

The screen time finding deserves particular emphasis given the study population. Only the yoga arm reduced daily device exposure meaningfully. Since neither protocol contained explicit digital-hygiene instruction, this most plausibly reflects transfer from attentional training rather than deliberate restriction, aligning with the self-regulatory mechanisms proposed in the mechanistic literature. The parallel reduction in smartphone addiction scores strengthens this reading.

Partial mediation through RMSSD indicates that autonomic recovery carries a substantial share of yoga's psychological benefit but not all of it. The residual direct effect of group membership implies additional contributions from cognitive and social components of practice that the present design cannot separate.

Limitations

Cluster allocation rather than individual randomisation permits residual workplace-level confounding. Participants and instructors could not be blinded, and the control arm's passivity leaves expectancy effects uncontrolled. Heart rate variability was assessed only in short-term supine recordings, omitting circadian and ambulatory dynamics. Screen time relied on device logs that do not distinguish occupational from discretionary use. The twelve-week horizon cannot establish whether gains persist, and the sample of urban knowledge workers restricts generalisation to other occupational contexts.

Conclusion

Among adults with heavy daily screen exposure, a twelve-week integrated yoga protocol restored psychophysiological balance more effectively than duration-matched aerobic exercise, producing larger improvements in perceived stress, sleep quality, anxiety, problematic smartphone use, heart rate variability and morning cortisol. Autonomic recovery partially mediated the psychological benefit, identifying vagal modulation as a concrete pathway rather than a general wellness claim. For organisations designing wellbeing programmes for digitally intensive roles, these findings suggest that interventions incorporating regulated breathing and attentional

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training offer advantages that physical activity alone does not supply. Longer follow-up with active-comparator designs and ambulatory autonomic monitoring is required to establish durability.

References

1. Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213.
2. Christensen, M. A., Bettencourt, L., Kaye, L., Moturu, S. T., Nguyen, K. T., Olgin, J. E., Pletcher, M. J., & Marcus, G. M. (2016). Direct measurements of smartphone screen-time: Relationships with demographics and sleep. *PLoS ONE*, 11(11), e0165331.
3. Chu, P., Gotink, R. A., Yeh, G. Y., Goldie, S. J., & Hunink, M. G. M. (2016). The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: A systematic review and meta-analysis of randomized controlled trials. *European Journal of Preventive Cardiology*, 23(3), 291–307.
4. Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396.
5. Cramer, H., Lauche, R., Langhorst, J., & Dobos, G. (2013). Yoga for depression: A systematic review and meta-analysis. *Depression and Anxiety*, 30(11), 1068–1083.
6. Elhai, J. D., Dvorak, R. D., Levine, J. C., & Hall, B. J. (2017). Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of Affective Disorders*, 207, 251–259.
7. Gard, T., Noggle, J. J., Park, C. L., Vago, D. R., & Wilson, A. (2014). Potential self-regulatory mechanisms of yoga for psychological health. *Frontiers in Human Neuroscience*, 8, 770.
8. Gothe, N. P., & McAuley, E. (2015). Yoga and cognition: A meta-analysis of chronic and acute effects. *Psychosomatic Medicine*, 77(7), 784–797.
9. Kwon, M., Kim, D. J., Cho, H., & Yang, S. (2013). The Smartphone Addiction Scale: Development and validation of a short version for adolescents. *PLoS ONE*, 8(12), e83558.
10. Lehrer, P. M., & Gevirtz, R. (2014). Heart rate variability biofeedback: How and why does it work? *Frontiers in Psychology*, 5, 756.
11. Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33(3), 335–343.
12. Pascoe, M. C., Thompson, D. R., & Ski, C. F. (2017). Yoga, mindfulness-based stress reduction and stress-related physiological measures: A meta-analysis. *Psychoneuroendocrinology*, 86, 152–168.
13. Riley, K. E., & Park, C. L. (2015). How does yoga reduce stress? A systematic review of mechanisms of change and guide to future inquiry. *Health Psychology Review*, 9(3), 379–396.
14. Shaffer, F., & Ginsberg, J. P. (2017). An overview of heart rate variability metrics and norms. *Frontiers in Public Health*, 5, 258.
15. Streeter, C. C., Whitfield, T. H., Owen, L., Rein, T., Karri, S. K., Yakhkind, A., Perlmutter, R., Prescot, A., Renshaw, P. F., Ciraulo, D. A., & Jensen, J. E. (2010). Effects of yoga versus walking on mood, anxiety, and brain GABA levels: A randomized controlled MRS study. *Journal of Alternative and Complementary Medicine*, 16(11), 1145–1152.
16. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. (1996). Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. *Circulation*, 93(5), 1043–1065.
17. Telles, S., Sharma, S. K., & Balkrishna, A. (2014). Blood pressure and heart rate variability during yoga-based alternate nostril breathing practice and breath awareness. *Medical Science Monitor Basic Research*, 20, 184–193.
18. Thayer, J. F., Åhs, F., Fredrikson, M., Sollers, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews*, 36(2), 747–756.
19. Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents: Evidence from a population-based study. *Preventive Medicine Reports*, 12, 271–283.
20. Tyagi, A., & Cohen, M. (2016). Yoga and heart rate variability: A comprehensive review of the literature. *International Journal of Yoga*, 9(2), 97–113.
21. Zaccaro, A., Piarulli, A., Laurino, M., Garbella, E., Menicucci, D., Neri, B., & Gemignani, A. (2018). How breath-control can change your life: A systematic review on psycho-physiological correlates of slow breathing. *Frontiers in Human Neuroscience*, 12, 353.