Research Article

# Vajarasana Yoga and Surya Nadi Pranayama Intervention on Cognitive Function Among Screen Based Professionals

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**Abstract**

**Background:** Prolonged screen-based work is associated with cognitive fatigue and reduced executive efficiency due to sustained sitting and attentional overload. Yoga and pranayama are simple, non-invasive interventions known to enhance autonomic regulation and mental alertness.

**Aim:** To evaluate the effect of short, hourly sessions of Vajrasana Yoga and Surya Nadi Pranayama on cognitive performance among screen-based professionals.

**Methods:** Sixty-seven computer-based employees aged 22–55 years participated in this study. Participants attended three sessions: familiarisation, prolonged sitting (control), and yoga–pranayama intervention. During the intervention session, participants performed Vajrasana and Surya Nadi Pranayama for five minutes every hour over four hours of desk work. Executive function was assessed at baseline, 2 hours, and 4 hours using the Eriksen Flanker Test and N-Back Working Memory Test. Reaction times were analysed using Repeated Measures ANOVA and Friedman's test.

**Results:** During uninterrupted sitting, mean reaction times increased progressively (Eriksen: 443→508 ms; N-Back: 489→512 ms). During the yoga–pranayama session, reaction times remained relatively stable (Eriksen: 458→458 ms; N-Back: 491→489 ms). Although differences were not statistically significant ($p > 0.05$), attenuation of reaction-time drift was observed during the intervention.

**Conclusion:** Brief hourly practice of Vajrasana Yoga and Surya Nadi Pranayama may help maintain executive performance during prolonged sedentary work. Larger randomised studies incorporating physiological measures are warranted.

**Keywords:** Executive function; Reaction time; Sedentary behaviour; Yoga; Pranayama; Occupational physiology

## Introduction

The modern workplace increasingly requires prolonged sitting, sustained attention, and continuous screen-based cognitive engagement. Prolonged sedentary behaviour has been associated with impairments in executive function, attention, and working memory (1). Higher sedentary exposure has also been linked to increased risk of cognitive decline and dementia, highlighting the broader neurocognitive consequences of sustained inactivity (2).

Interventions that interrupt prolonged sitting with light physical activity or postural change have demonstrated potential benefits, though findings remain heterogeneous (3). Evidence examining short-duration mind–body interventions, such as yoga and controlled breathing, within occupational settings remains limited (4).

Yoga and pranayama practices are recognised for their influence on autonomic nervous system regulation and cortical activation (7). Vajrasana promotes postural alignment and musculoskeletal stability, while Surya Nadi Pranayama (right-nostril breathing) has been associated with enhanced alertness through sympathetic activation (9). The present study examined whether brief, hourly yogic micro-breaks could mitigate cognitive fatigue during prolonged screen-based work.

## Materials and Methods

### Study Design

This was a cross-sectional pilot study conducted in a controlled laboratory setting following approval by an Institutional Ethics Committee. Written informed consent was obtained from all participants prior to

enrolment.

Participants

Screen-based professionals aged 22–55 years, engaged in desk-based work for at least six hours per day, were included. Individuals with known neurological, psychiatric, endocrine, or major musculoskeletal disorders, or those practising yoga regularly within the preceding six months, were excluded.

Study Procedure

Participants attended three sessions conducted under similar ambient and temporal conditions to minimise circadian variation.

- Session 1: Familiarisation with yoga practices and cognitive testing
- Session 2: Prolonged sitting (control), involving four hours of uninterrupted desk work
- Session 3: Yoga–pranayama intervention, involving five minutes of Vajrasana followed by Surya Nadi Pranayama performed every hour during four hours of desk work

Executive function was assessed at baseline (0 h), 2 h, and 4 h using the Eriksen Flanker Test and N-Back Working Memory Test.

Description of the Intervention

- Vajrasana: Sitting on the heels with an erect spine and hands resting on the thighs, accompanied by slow, rhythmic breathing
- Surya Nadi Pranayama: Slow inhalation through the right nostril followed by passive exhalation through the left nostril

Outcome Measures

The primary outcome measure was reaction time (milliseconds) obtained from the Eriksen Flanker and N-Back tests.

Statistical Analysis

Data were analysed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation. Repeated Measures ANOVA and Friedman's test were applied as appropriate. A p value $< 0.05$ was considered statistically significant.

## RESULTS

**Participant Demographics and Lifestyle Characteristics**

A total of 67 screen-based professionals were included in the analysis. Participants were aged between 22 and 55 years, with an approximately equal gender distribution. The mean age was 38.8 ± 9.1 years. The mean body mass index (BMI) was 27.5 ± 5.7 kg/m², with more than 60% of participants classified as overweight or obese according to WHO Asia–Pacific criteria. The average daily screen exposure was 7.5 ± 1.3 hours. Most participants reported low levels of physical activity (76.1%). Occasional alcohol consumption was reported by 43.3% of participants, while 23.9% were receiving regular medication for chronic conditions. The demographic and lifestyle characteristics of the study population are summarised in **Table 1**, **Figure 1.**

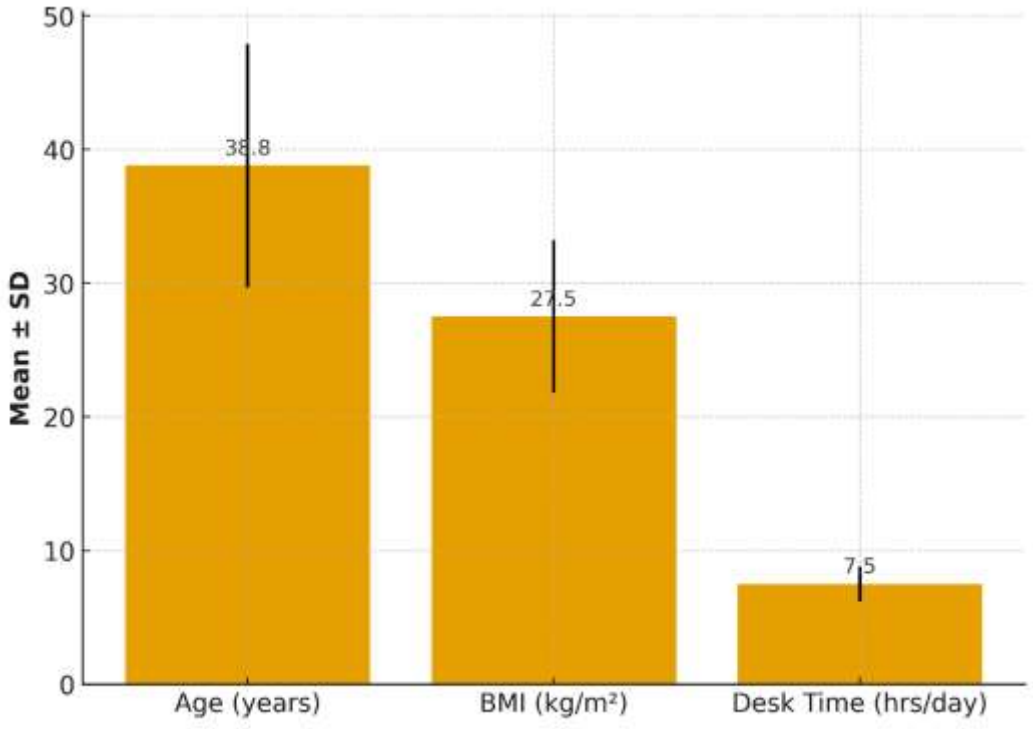
**Table 1. Demographic and Lifestyle Characteristics of Participants (n = 67)**

| Parameter | Category | Frequency (n) | Percentage (%) | Mean ± SD (where applicable) |
|---|---|---|---|---|
| **Age (years)** | 22–30 | 14 | 20.9 | , |
| | 31–40 | 26 | 38.8 | , |
| | 41–50 | 17 | 25.4 | , |
| | ≥51 | 10 | 14.9 | **38.8 ± 9.1** |
| **Gender** | Male | 35 | 52.2 | , |
| | Female | 32 | 47.8 | , |
| **BMI (kg/m²)** | < 23 (Normal) | 13 | 19.4 | , |

| Parameter | Category | Frequency (n) | Percentage (%) | Mean ± SD (where applicable) |
|---|---|---|---|---|
| | 23–27.4 (Overweight) | 31 | 46.3 | , |
| | ≥ 27.5 (Obese) | 23 | 34.3 | **27.5 ± 5.7** |
| **Daily Screen Time (hours)** | < 6 | 11 | 16.4 | , |
| | 6–8 | 42 | 62.7 | , |
| | > 8 | 14 | 20.9 | **7.5 ± 1.3** |
| **Physical Activity** | Active | 16 | 23.9 | , |
| | Inactive | 51 | 76.1 | , |
| **Alcohol Consumption** | Yes | 29 | 43.3 | , |
| | No | 38 | 56.7 | , |
| **On Regular Medication** | Yes | 16 | 23.9 | , |
| | No | 51 | 76.1 | , |

Note: BMI categorization based on WHO Asia-Pacific guidelines. Desk time values reflect self-reported daily averages.

**Figure 1. Mean Distribution of Age, BMI, and ScreenTime among Participants**




Bar chart showing mean ± SD values for Age (38.8 ± 9.1 years), BMI (27.5 ± 5.7 kg/m²), and Screen Time (7.5 ± 1.3 hours/day).

**Cognitive Performance During Prolonged Sitting and Yoga–Pranayama Conditions**

During the prolonged sitting condition, participants engaged in uninterrupted desk-based work for four hours. Executive function was assessed at baseline (0 h), 2 h, and 4 h using the Eriksen Flanker Test and N-Back Working Memory Test. Reaction times increased progressively across time points. Mean Eriksen reaction time increased from 443 ± 52 ms at baseline to 467 ± 56 ms at 2 h and 508 ± 61 ms at 4 h. Mean N-Back reaction time increased from 489 ± 50 ms at baseline to 512 ± 53 ms at 2 h and remained at 512 ± 54 ms at 4 h (Table 2; Figures 2) .

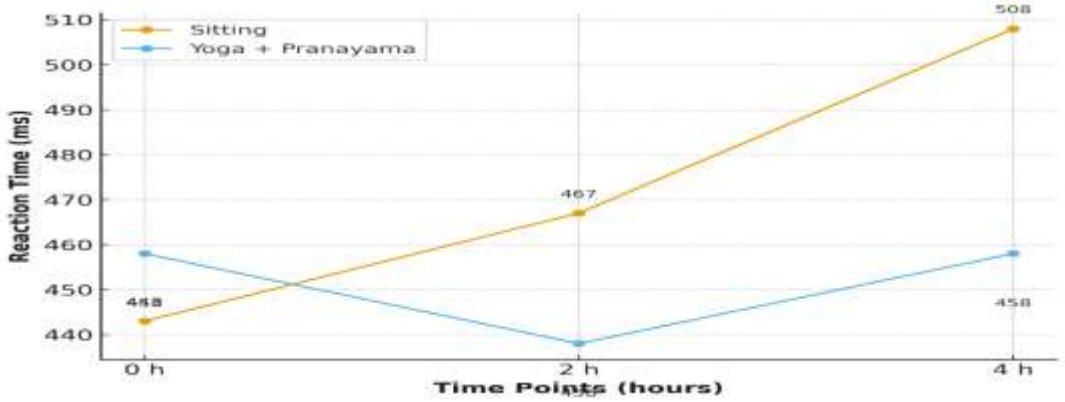
During the yoga–pranayama condition, participants performed Vajrasana Yoga followed by Surya Nadi Pranayama for five minutes every hour over the same four-hour period. Reaction times during this condition remained relatively stable. Eriksen reaction times were 458 ± 42 ms at baseline, 438 ± 39 ms at 2 h, and 458 ± 44 ms at 4 h. N-Back reaction times were 491 ± 41 ms at baseline, 482 ± 39 ms at 2 h, and 489 ± 43 ms at 4 h. None of the within-condition differences reached statistical significance on Friedman analysis ($p > 0.05$) (Table 2; Figure 3)

Figure 2 illustrated reaction time changes in the Eriksen Flanker Test across time points during prolonged sitting and yoga–pranayama conditions. Figure 3 depicted reaction time trends in the N-Back Working Memory Test across the same intervals. Reaction-time trajectories differed between conditions, with prolonged sitting associated with progressive slowing and the yoga–pranayama condition demonstrating flatter temporal profiles .

**Table 2. Summary of Cognitive Test Scores Across Time Points**

| Parameter | Condition | 0 h (Mean ± SD) | 2 h (Mean ± SD) | 4 h (Mean ± SD) | p-value (Friedman) | Interpretation |
|---|---|---|---|---|---|---|
| **Eriksen Reaction Time (ms)** | Sitting | 443 ± 52 | 467 ± 56 | 508 ± 61 | 0.96 | Not significant |
| | Yoga + Pranayama | 458 ± 42 | 438 ± 39 | 458 ± 44 | 0.42 | Not significant |
| **N-Back Reaction Time (ms)** | Sitting | 489 ± 50 | 512 ± 53 | 512 ± 54 | 0.63 | Not significant |
| | Yoga + Pranayama | 491 ± 41 | 482 ± 39 | 489 ± 43 | 0.86 | Not significant |

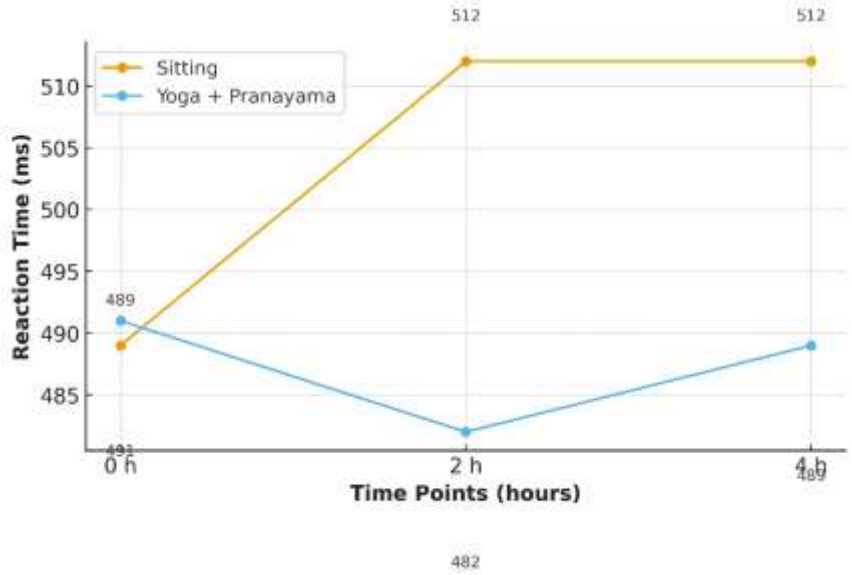
**Figure 2. Eriksen Flanker Test Reaction Times Across Time Points during Sitting and Yoga-Pranayama Sessions**




Line chart comparing mean reaction times (ms) across 0 h, 2 h, and 4 h during Sitting and Yoga-Pranayama

conditions.

**Figure 3. N-Back Test Reaction Times Over Time During Prolonged Sitting and Yoga–Pranayama Intervention**




Line graph depicting mean reaction times (ms) at 0 h, 2 h, and 4 h for Sitting and Yoga–Pranayama conditions, demonstrating stable working-memory performance during intervention.

**Summary of Quantitative Findings**

Although statistical significance was not achieved, reaction time trajectories differed between conditions. Prolonged sitting was associated with a gradual increase in reaction time, whereas the yoga–pranayama condition demonstrated flatter reaction-time profiles across repeated measurements.

**Interpretive Summary and Overall Interpretation**

The study population represented a typical sedentary office-working cohort, characterised by middle age, elevated body mass index, and prolonged daily screen exposure (Table 3). During uninterrupted sitting, reaction times increased progressively across testing intervals, indicating gradual cognitive slowing. In contrast, when brief Vajrasana postures and Surya Nadi Pranayama were incorporated at hourly intervals, reaction-time patterns demonstrated relative stabilisation, suggesting improved cognitive resilience.

Although statistical significance was not achieved, the consistency of flatter reaction-time trajectories and reduced variability during the intervention indicates potential functional preservation of attention and executive performance. From an occupational health perspective, these findings support the feasibility of integrating brief, low-cost, and culturally acceptable yogic breaks into routine screen-based work to mitigate cognitive fatigue and support sustained work performance.

**Table 3. Summary of Lifestyle Parameters (Mean ± SD)**

| Parameter | Mean | SD |
|---|---|---|
| Age (years) | 38.8 | 9.1 |
| BMI (kg/m²) | 27.5 | 5.7 |
| Screen Time (hrs/day) | 7.5 | 1.3 |

## Discussion

The present study examined whether short, hourly sessions of Vajrasana Yoga and Surya Nadi Pranayama could mitigate cognitive fatigue associated with prolonged sitting among screen-based professionals. The intervention was associated with stabilisation of reaction times in both the Eriksen Flanker and N-Back tests, whereas uninterrupted sitting resulted in a progressive slowing of responses. Although the Friedman test did not demonstrate statistical significance ($p = 0.42$ for Eriksen; $p = 0.86$ for N-Back), the attenuated rise in mean reaction time during the yoga–pranayama condition suggests a physiological effect that may be of practical relevance for sustained cognitive performance.

Prolonged sedentary work has been shown to impair attention and executive control, with uninterrupted computer-based tasks inducing cognitive fatigue and delayed responses, as reported by studies examining prolonged computer use (12). In contrast, yoga- and breathing-based interventions have demonstrated improvements in executive performance and working-memory accuracy following both long-term training and short bouts of controlled breathing, as shown by Deepeshwar and Budhi (13). A six-month yoga intervention conducted by Paramashiva et al. demonstrated enhancements in working memory, inhibitory control, and cognitive flexibility (14). Slow yogic breathing at approximately six breaths per minute has also been shown to acutely improve working-memory performance (Deepeshwar and Budhi, 13). Controlled breathing exercises have similarly been associated with superior executive function outcomes compared with control conditions, as reported by Laborde et al. (15).

The favourable trend observed may reflect combined autonomic rebalancing and improved cerebral perfusion. Vajrasana supports postural alignment and venous return during prolonged sitting (Young, 16), while Surya Nadi Pranayama selectively enhances cortical arousal through sympathetic activation (Bargal et al., 17), with reported benefits for reaction time and alertness (Lee et al., 18).

**Study Limitations**

The modest sample size ($n = 67$) and short intervention duration may have limited statistical power, while absence of physiological correlates such as heart-rate variability or cerebral haemodynamics restricted mechanistic confirmation; nevertheless, consistent directional trends and reduced reaction-time variability suggest biological plausibility.

**Future Scope and Practical Implications**

Future studies should employ larger randomised controlled designs and incorporate objective neurophysiological markers such as heart-rate variability (HRV), electroencephalography (EEG), and near-infrared spectroscopy (NIRS) to elucidate neural and autonomic mechanisms. If substantiated, brief hourly yogic micro-breaks could serve as a feasible, low-cost, and culturally adaptable workplace strategy to preserve cognitive performance, reduce mental fatigue, and promote occupational well-being among screen-based professionals.

## Conclusion

The findings suggest that short, hourly sessions of Vajrasana Yoga and Surya Nadi Pranayama during prolonged desk work were associated with stabilised reaction time and reduced cognitive fatigue among screen-based professionals. Although changes were not statistically significant, consistent trends toward improved attention and working-memory steadiness indicate physiological relevance. Given its simplicity, low cost, and cultural acceptability, this yogic micro-break protocol may support occupational well-being and sustained mental performance. Larger randomised studies with objective physiological markers are needed to confirm these findings.

## References

1. Cai X ye, Qian G ping, Wang F, Zhang M yang, Da Y juan, Liang J hong. Association between sedentary behavior and risk of cognitive decline or mild cognitive impairment among the elderly: a systematic review and meta-analysis. Front Neurosci. 2023 Aug 4;17:1221990.
2. Raichlen DA, Aslan DH, Sayre MK, Bharadwaj PK, Ally M, Maltagliati S, et al. Sedentary Behavior and Incident Dementia Among Older Adults. JAMA. 2023 Sep 12;330(10):934–40.

3. Pindus DM, Selzer-Ninomiya A, Nayak A, Pionke J, Raine LB. Effects of reducing sedentary behaviour duration by increasing physical activity, on cognitive function, brain function and structure across the lifespan: a systematic review protocol. BMJ Open. 2022 Oct 21;12(10):e046077.
4. Phansikar M, Gothe N, Hernandez R, Lara-Cinisomo S, Mullen SP. Feasibility and impact of a remote moderate-intensity yoga intervention on stress and executive functioning in working adults: a randomized controlled trial. J Behav Med. 2023 Oct 1;46(5):720–31.
5. Effects of Office-Yoga and Walking at the Workplace to Improve Health and Wellbeing: A Longitudinal Randomized Controlled Trial | Occupational Health Science [Internet]. [cited 2025 Oct 14]. Available from: https://link.springer.com/article/10.1007/s41542-024-00194-y?utm_source=chatgpt.com
6. Frontiers | Feasibility of a remotely-delivered yoga intervention on cognitive function in breast cancer survivors: a mixed-methods study [Internet]. [cited 2025 Oct 14]. Available from: https://www.frontiersin.org/journals/cognition/articles/10.3389/fcogn.2023.1286844/full?utm_source=chatgpt.com
7. Frontiers | Neural correlates of breath work, mental imagery of yoga postures, and meditation in yoga practitioners: a functional near-infrared spectroscopy study [Internet]. [cited 2025 Oct 14]. Available from: https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2024.1322071/full?utm_source=chatgpt.com
8. Campelo G, de Araújo JR, Aristizabal JP, de Souza W, de Castilho GM. Long-term effects of yoga-based practices on neural, cognitive, psychological, and physiological outcomes in adults: a scoping review and evidence map. BMC Complement Med Ther. 2025 Mar 6;25(1):92.
9. Kaushik M, Yadav A, Upadhyay A, Gupta A, Tiwari P, Tripathi M, et al. Yoga an integrated mind body intervention for improvement in quality of life in individuals with Alzheimer's disease and their caregivers. Front Aging. 2025 Mar 21;6:1449485.
10. Telles S, Sharma SK, Chetry D, Balkrishna A. Benefits and adverse effects associated with yoga practice: A cross-sectional survey from India. Complement Ther Med. 2021 Mar;57:102644.
11. Chatterjee S, Mondal S, Singh D. Effect of 12 Weeks of Yogic Training on Neurocognitive Variables: A Quasi-Experimental Study. Indian J Community Med. 2021 Mar;46(1):112.
12. (PDF) Effects of prolonged continuous computer gaming on physical and ocular symptoms and binocular vision functions in young healthy individuals. ResearchGate [Internet]. 2025 Aug 12 [cited 2025 Oct 15]; Available from: https://www.researchgate.net/publication/333612479_Effects_of_prolonged_continuous_computer_gaming_on_physical_and_ocular_symptoms_and_binocular_vision_functions_in_young_healthy_individuals
13. Deepeshwar S, Budhi RB. Slow yoga breathing improves mental load in working memory performance and cardiac activity among yoga practitioners. Front Psychol. 2022 Sep 14;13:968858.
14. paramashiva PS, K A, K V, K.n. S, Chandrasekaran B, Reddy GG, et al. Impact of a six-month yoga intervention on cognitive performance among desk-based workers: An interrupted time-series design. Adv Integr Med. 2025 Sep 1;12(3):100441.
15. Laborde S, Mosley E, Thayer JF. Heart Rate Variability and Cardiac Vagal Tone in Psychophysiological Research - Recommendations for Experiment Planning, Data Analysis, and Data Reporting. Front Psychol. 2017;8:213.
16. Young DB. Venous Return. In: Control of Cardiac Output [Internet]. Morgan & Claypool Life Sciences; 2010 [cited 2025 Oct 15]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK54476/
17. Bargal S, Nalgirkar V, Patil A, Langade D. Effect of Right Nostril Breathing on Cardiorespiratory Parameters and Reaction Time in Young, Healthy Humans: An Interventional Study. Indian J Community Med Off Publ Indian Assoc Prev Soc Med. 2024;49(2):303–7.
18. Lee K, M.D, Kim H, M.D, Ph.D, Cho S, et al. Change of Venous Return after Diaphragmatic Deep Breathing. Ann Phlebol. 2022 Dec 31;20(2):95–9.