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Effect of Suryanamaskar Practice on Concentration Ability among University Students: A Comparative Study

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ABSTRACT

This study examined the effect of a structured Suryanamaskar Practice programme on concentration ability among university students at Rajiv Gandhi University, Arunachal Pradesh, using the VTS Test Form S4. The intervention consisted of a structured Suryanamaskar practice programme, preceded by an opening prayer and Sukshma Vyayam (loosening exercises), Sueyanamaskar Practice and followed by a closing prayer and deep relaxation techniques, including merudanada asana and savasana. Forty participants were selected through simple random sampling, with 20 assigned to the experimental group and 20 to the control group. Data were collected through pre-test and post-test assessments. Results showed a significant increase in concentration ability, with the mean score rising from 56.35 to 74.65. A paired sample t-test confirmed the effectiveness of the intervention ($t = -4.09$, $p < .001$). After controlling for pre-test scores, a significant group effect was observed ($F = 40.08$, $df = 1$, $p < .001$, $\eta^2p = .52$), indicating significant improvement in the experimental group, while no significant change occurred in the control group, which received no treatment. The findings highlight the potential of Suryanamaskar for improving concentration ability among university students and contributing to overall health promotion. The findings supports integrating Suryanamaskar into educational and wellness programs and suggests future research on the long-term sustainability of concentration improvement and the psychological mechanisms underlying these outcomes.

INTRODUCTION

Yoga is a worldwide phenomenon that integrates the physical, mental and spiritual aspects of human life. It is widely practised in contemporary society as an effective strategy for managing stress and also as a holistic approach to physical fitness and well-being (White, 2012). The main schools of yoga, Karma Yoga, Bhakti Yoga, Raja Yoga, Jnana Yoga, and Hatha Yoga, emphasise the attainment of spiritual perfection through mastery of the body and mind. The practices make use of different Yoga techniques, such as Asana, Pranayama, Mudras, Dharna, Dhayana, Satkarma, and Bandhas, to facilitate self-realisation and internal harmony of an individual (Stec *et al.*, 2023). Yoga creates a state of balance in which the practitioner develops a greater awareness of his or her mental and physical states through the alignment of movement, respiration, and focus. Within this framework, flexibility is the capacity of soft tissues like muscles, tendons, fascia, joint capsules, ligaments and neurovascular structures to move pain-free through a joint's range of motion (Bhavanani *et al.*, 2011). Soft tissue structure and neuromuscular factors such as muscle tone, proprioceptive feedback, and sensory receptor responsiveness affect flexibility (Karasugi *et al.*, 2023). The nervous system regulates the amount and rate of muscular stretch, providing biomechanical safety and functional efficacy (Godse *et al.*, 2015). Yoga provides a powerful means of such regulation, integrating body, breath and mind to reduce the physiological and

psychological effects of stress, thus fostering holistic well-being (Bhavanani *et al.*, 2011). The history of Surya Namaskar, the sun worship as a god, is in vogue since the time of the Rigveda, composed sometime between 1500-1000 BCE. The hymns of the Rigveda extol Surya, the sun, and rituals are performed for this deity (Venkatesh & Vandhana, 2021). The most famous is, of course, the Gayatri Mantra. There are two forms of the Surya Namaskar, which also originated from Vedic texts. These are "Trucha Kalpa Namaskarah" and "Aditya Prasna". Three ruchas, or Vedic hymns, are used in the Trucha Kalpa Namaskarah method of conducting Surya Namaskar. It entails reciting twelve unique Hindu mantras in a certain order, starting with the Dhyana mantra and ending with Surya Namaskara (Prasanna Venkatesh & Vandhana, 2022). These mantras, each accompanied by twelve postures, were written by Kanva Rishi with the intention of pleasing the Sun and curing illnesses. The practice of Suryanamsakr executing 108 Namaskaras in a single day as traditional practice (Gohil, 2012). "Aditya Prasna" makes use of passages from the Yajurvedic Taittiriya Aranyaka. In South India, this type of Surya Namaskar is widely performed. The epic Ramayana mentions another ancient technique comparable to Surya Namaskar, which is credited to the sage Valmiki. As part of the narrative, Adityahadayam describes a more basic version of Surya Namaskar (Tompkins, 2016).

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Objective

Vienna Test System (VTS) Cognitron Test Form S4 measures the Concentration Ability of the Cognitive aspects.

MATERIALS AND METHODS

This research study was conducted to identify the effect of completing six weeks of Suryanamaskar practice upon concentration levels and the ability to concentrate of university students using an experimental pre-test and post-test control group design. A total of forty university students aged between 18 and 25 years took part in the research, drawn from a simple random sampling selection. Participants were then randomly assigned to an experimental group (N:20) and a control group (N:20). The measuring tool Vienna Test System (VTS) Cognitron Test Form S4, was used to measure concentration levels, which were standardised assessment instruments for both pre-test and post-test measurements.

Inclusion and exclusion criteria

Inclusion criteria: students aged 18-25 years, no history

of medical transplant, not on any special diet, no use of medication, no history of osteoporosis, no frequent dizziness, no psychiatric disorder or emotional trauma in the past 5-6 months, and no recent surgery.

Exclusion criteria: unwillingness to continue the scheduled Suryanamaskar practice session, engagement in other activities or any intervention likely to affect the physical, physiological and psychological indices.

Sample size

For the study, 85 university students registered for the study, and 40 met the inclusion criteria. The sample size was calculated based on a standard deviation of 5.6, mean difference of 6.4, a minimum detectable difference of 5, a significance level (α) of 5, and power ($1-\beta$) of 0.90, resulting in 20 participants per group (40 in total). Eligible participants were randomly assigned to either Group A(Intervention) or Group B(Control) using a table of random numbers cited at Figure 1.

Randomization

For this study, the eligible participants were randomly

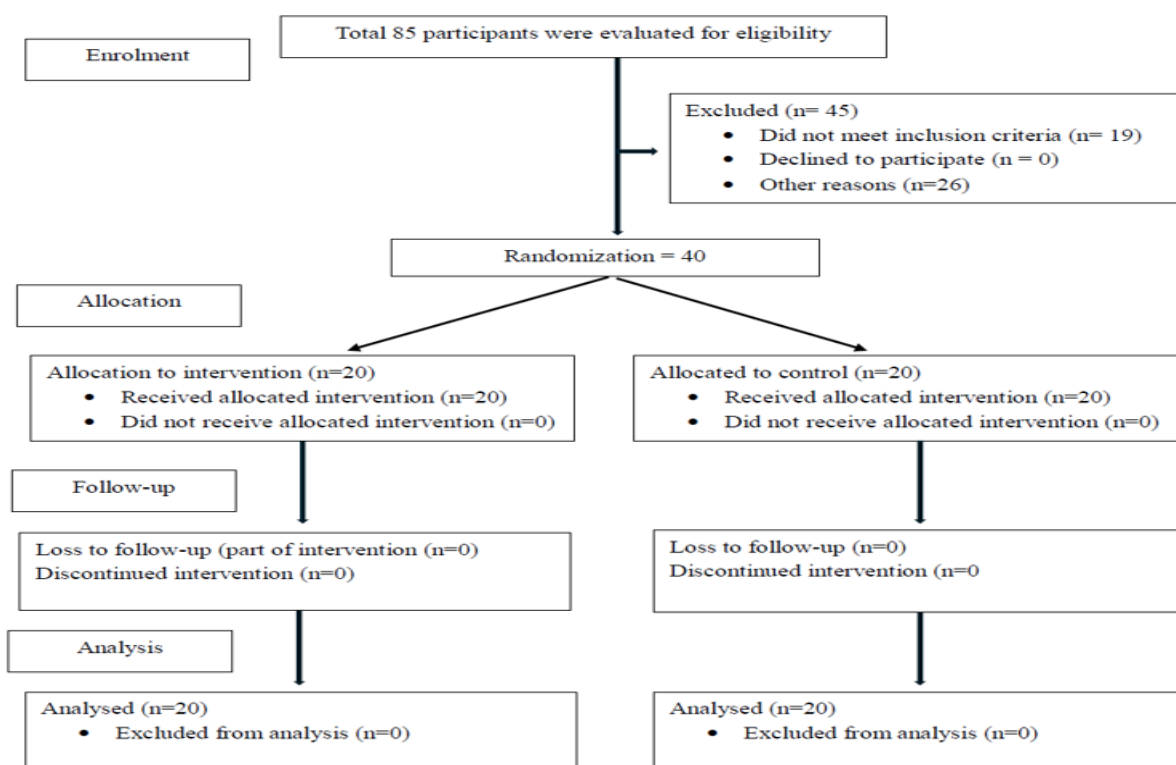


Figure 1: The CONSORT flowchart outlining the progression of participants through the study

assigned to Group A(Intervention) or Group B (Control) using a table of random numbers cited at [Figure 1]. This research study incorporated a standard parallel arm design, consisting of eligibility screening, consent, randomization and allocation into either the intervention (test) or control group.

Blinding

Due to the nature of the investigation, participants and instructions were not blinded. Outcome assessors

and data analysts were not informed of the study hypothesis. However, blinding to group allocation was not incorporated.

Test protocol: To commence the measurements, the Cognitron Test Form S4, was used to measure the concentration ability of the students, and 40 participants from the different courses run by Rajiv Gandhi University were tested. The Cognitron Test form S4 with a fixed presentation time of 1.8 sec. per item for S4 was incorporated. For test form S4 with a fixed working

time, the respondents were instructed to react only when the comparison figure corresponds to one of the four reference figures. Once the presentation time has expired, the next item follows automatically. It is not possible to omit an item or to go back to a preceding one (Teteris *et al.*, 2025). Individual testing with the Cognitrone (COG) Test was conducted under standardised conditions with participants. Before the actual test, respondents experienced an instruction phase (with animated instructions) and a practice phase to familiarise themselves with the process. During testing, the subject was shown a comparison figure and four reference figures on the computer screen. The subject had to select the reference figure closest to the comparison figure. Reactions were registered by the computer response panel or keyboard. Upon completion of the practice phase, participants conducted the full test independently, and responses were automatically recorded for later data analysis. The main variable of the test forms is the ability to concentrate. Test form S4 it measures accuracy during concentrated working. This includes test forms S4 in which the respondents have an equally long, period available for comparing a comparison sample with the reference samples. This period is 1.8 seconds. The test duration for test form S4, including instructions, is approx. 8 minutes (Veliks *et al.*, 2023).



Figure 2: The Vienna Test System Test – Form S4 test procedure.

Training protocol: The intervention includes a structured Suryanamaskar training, complemented at the start of the training program it was incorporated with opening prayer and Sukshma Vyayam (loosening exercise), and at the end of the training session, closing prayer and deep relaxation techniques such as merudanada asana (crocodile practice), savasana (death posture), were incorporated, to determine whether the structured Suryanamaskar training yields measurable improvements in concentration ability among the students in the current measure, the training regimen

Table 1: Six weeks, Suryanamaskar Practice Session

Week	Frequency	Rounds/ session	Targeted structure	Recover protocol	Observation and supervision	Duration/session
1-2 week	Five sessions/ week	12-14 rounds	2 sets of 7 rounds	10-12 second pause between rounds, 1 minute after every round	Instruction (first 4 sessions) and independent.	45 to 60 minutes (Include: Prayer, warm- up, and relaxation, followed by opening and closing prayer.
3-4 weeks	Five sessions/ week	15-21 rounds	3 set of 7 rounds	8-10 second pause between rounds 1 minute after every round	Instruction (first 4 sessions) and independent.	45 to 60 minutes (Include: Prayer, warm- up, and relaxation, followed by opening and closing prayer.
5-6 weeks	Five sessions/ week	22-28 rounds	4 set of 7 rounds	4-6 second pause between rounds 1 minute after every round	Instruction (first 4 sessions) and independent.	45 to 60 minutes (Include: Prayer, warm- up, and relaxation, followed by opening and closing prayer.

of Suryanamaskar was implemented for a period of six weeks. Each training session started with a 10-minute warm-up period of gentle joint mobilization and breath-awareness practice, advancing to systematic practice of Suryanamaskar. Participants trained five days per week and marched through a progressive training regimen to complete 12 rounds in the first two weeks, 18 rounds in weeks 3-4, and 24 rounds in weeks 5-6. During training sessions, participants practised postures in synchrony with breathing, maintained a stable gaze as a strategy

to build concentration ability, and practised dynamically with a steady rhythm throughout transitions as presented in Table 1. There was a five-second pause between each round and a one-minute recovery break after every six rounds to aid rest and focus. The first four trainings were supervised by the instructor, and afterwards the participants continued practising on their own. Each practice session lasted approximately 45 - 60 minutes, including warm-up and recovery.

RESULTS AND DISCUSSION

The results section presents the analysed data obtained from participants, including descriptive statistics and comparative outcomes. The findings highlight the key patterns, differences, and significant results obtained from the study's measurements of a six-week Suryanamaskar intervention.

The descriptive statistics are presented in Table 2, indicating a notable improvement in concentration ability after six weeks of Suryanamaskar practice. The mean pre-

test score of the Experimental Group (EG) was 56.35 (SD=21.45), while the post-test score increased to 74.65 (SD=13.72). The mean pre-test score of the Control Group (CG) was 58.4 (SD=17.56), while the post-test score indicates no significant change. This represents a mean gain of -9.150 points, suggesting a substantial improvement in concentration ability among university students after six weeks of Suryanamaskar intervention training program in the experimental group (EG).

Table 2: Descriptive results of Pre-Test and Post-Test of Suryanamaskar Intervention among University Students.

Study Groups	Test	Mean	St. Deviation	St. Error Mean
Experimental Group	Pre test	56.35	21.45	4.79
	Post Test	74.65	13.72	3.06
Control Group	Pre test	58.4	17.56	3.92
	Post Test	58.4	17.56	3.92

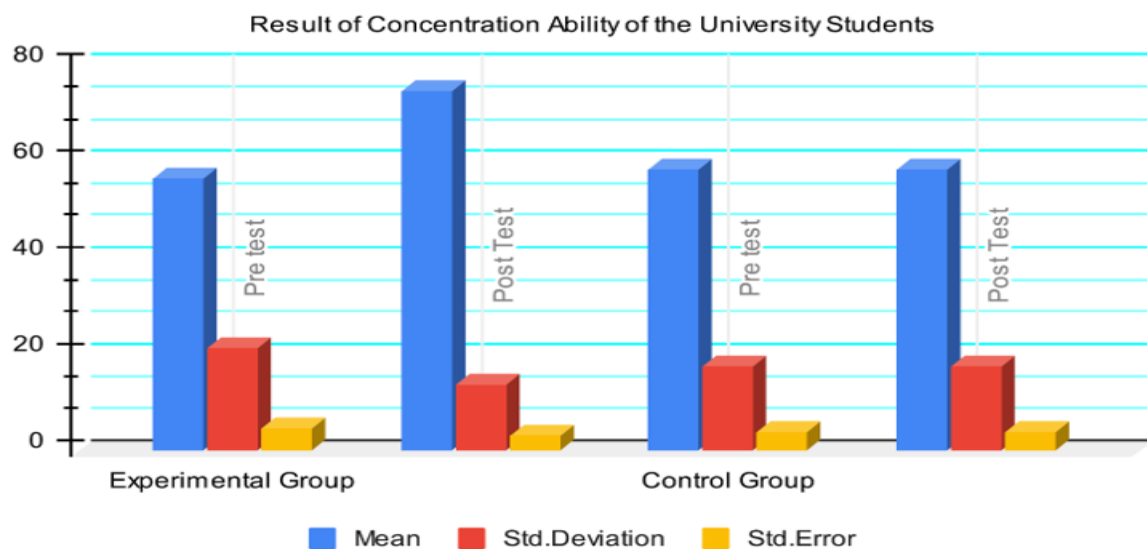


Figure 3: Graph shows the results of the pre-and post-test of Suryanamaskar Intervention among University Students.

The findings presented in Table 3 reveal a significant improvement in concentration ability among the participants following six weeks of the Suryanamaskar training program. The mean pre-test score of the Experimental Group (EG) was 56.35 (SD=21.45), while the post-test score increased to 74.65 (SD=13.72). The mean pre-test score of the Control Group (CG) was 58.4 (SD=17.56), while the post-test score indicates no significant change. Therefore, yielding a mean difference of -9.150 points, SD=14.130, St. Error=2.234, as presented in Table 3.

The result of the paired sample t-test indicates that

this difference is statistically significant, $t(39) = -9.150$, $p < .001$. This suggests that the observed improvement in students' concentration was not due to chance but rather to the effect of the Suryanamaskar intervention over six weeks.

Additionally, the reduction in standard deviation from pre-test to post-test indicates greater consistency among participants after the Suryanamaskar intervention for six weeks. The results confirm that the Suryanamaskar intervention for six weeks of structured practice produced a significant and reliable enhancement in concentration ability that supports previous findings.

Table 3: Results of the mean, Standard Deviation (SD), and 't' value of pre- test and post-test of Suryanamaskar practice

		Mean	Std. Deviation	St. Error Mean	t	df	Sig.
Pair 1	Concentration Ability Pre Test- Concentration Ability Post Test	-9.15	14.130	2.23	-4.09	39	.001

A univariate ANOVA was conducted to assess the effect of the Suryanamaskar intervention on the pre-test and post-test experimental and control groups design, using a Veinna Test Cognitrone Test Form S4 for Concentration ability in university students. There was a significant interaction as presented in Table 4, such as $f(39) = 40.083$,

$p < .001$, $n2p = .50$

Therefore, the experimental group improved significantly more than the control group from pre-test to post-test. Due to the intervention of the structured Suryanamaskar training program for six weeks on the Experimental Group.

Table 4: Results of the dependent variable- univariate analysis of variance of Concentration ability post-test of the Suryanamaskar training program.

source	ss	df	f	p	n2p
group	3097.82	1	40.08	<.001	.52
Total	189101.00	40			

Discussion

In previous studies, the effect of Yoga on sustained attention in students for academic excellence is considered to be an essential part of a neuropsychological evaluation. With the recent rise in cognitive decline in the ageing population, the study deals with the effect of Suryanamaskar in enhancing cognitive function (Singh *et al.*, 2025). The study found significant improvement in the cognitive function of the experimental group when compared to the control group. Suryanamaskar is a Yogic Practice composed of dynamic muscular movements that are synchronised with an in-depth rhythmic breathing process and considered the best all-around exercise, it had a significant effect on the improvement of cognitive functions among medical students (Phansikar & Mullen, 2021). The combined yoga practice is associated with higher cognitive performance in medical students. The effects of Suryanamaskar and pranayama are beneficial in improving cognitive function (Ambareesha & Srikanth, 2017). Yoga can improve executive functioning and psychological well-being and it suggests that the flow-based forms of Yoga can induce immediate improvement in well-being, yet extended involvement may be required to realized performance improvement in memory and processing speed (Phansikar & Mullen, 2021). Suryanamaskar, or Sun Salutation, is an ancient Indian method of offering prayers to the rising sun in the morning with a series of physical postures with regulated breathing, aiming at a range of physical, mental, and spiritual benefits. The Suryanamaskar practice improved attentional network performance of the participants (Kondam *et al.*, 2015). The suggested finding provides a robust theoretical and practical framework for this research study exploring Suryanamaskar intervention and its effect on the concentration ability of the students. The Vienna Test System (VTS) was used to compare athletes and non-athletes as well as those from different sports levels. It was used to investigate and compare the effect of athletic cognitive performance (Ong, 2015). Social intelligence and emotional style are significant factors in maintaining a healthy interpersonal contributions to one's mental health as comprehensive investigation revealed there are significance enhancement among university

students related to social intelligence and emotional style (Gonzaga *et al.*, 2024). The literature review shows that artistic activities cultivate creative thinking skills during the early stage, identifying the profound impact on children's cognitive, emotional and social development and emphasizes innovative and balanced approach among students (Alghufali, 2024).

Moreover, the observed mean differences of -9.150 points in this VTS Cognitrone Test form S4 align with the expected outcomes based on the principles of Suryanamaskar. Suryanamaskar incorporates a variety of movements, breathing variations, focus and attention patterns for joint mobility, muscle elasticity and concentration ability. Thus, the current findings not only contribute to the body of evidence supporting the effectiveness of Yoga and Suryanamaskar for Concentration, Physical Health, but also underscore its potential role in promoting overall quality and wellness of a human being

CONCLUSION

This study demonstrated a significant improvement in Concentration ability of university students. The post-test score reveals that the consistent Suryanamaskar practice effectively improved concentration ability and confirms Suryanamaskar's vital role as a scientifically supported method for improving concentration as well as cognitive ability. These outcomes, with reference to the earlier research findings, indicate that regular Suryanamaskar practice inculcates and foster improved concentration ability among students.

Moreover, the results underscore that Suryanamaskar practice and its broader implications as an inculcative for the improvement of concentration ability. The integration of Yoga or Suryanamaskar in the educational curriculum can thus be an effective approach for enhancing psychological as well as physical well-being for promoting holistic health and encouraging sustainable wellness among students. Future research should be on these findings by incorporating a larger population and longer training period to examine the longitudinal effect of Suryanamaskar intervention on Concentration ability and academic-based performance.

List of abbreviations

VTs: Vienna Test System

SN: Suryanamaskar

COG: Cognitive

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Ethical approval

Not applicable.

CrediT authorship contribution statement

Umesh Mimi - writing, review & editing, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization, formal analysis. Prof. Sambhu Prasad - Visualization, Project administration, Methodology, Validation. Dr. Anil Mili - Visualization, Validation, Resources, Methodology. Dawa Tsering - Investigation, Formal analysis, Data curation, Conceptualization. Puri Doni - Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in this writing process

During the preparation of this work, the authors used AI Fiesta and ChatGPT (OpenAI's language model) to correct grammar and improve readability for clarity and coherence. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Declaration of competing interests

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Data availability

Data is provided within the manuscript. The datasets used/or analyzed during the study are available from the corresponding authors on reasonable request.

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