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Original Research Paper

Development, Content Validation and Comparative Effects of Nakshatra Vinyasa on Lung Function and Cardiovascular Function in Healthy Young Adults: A Three-Arm Randomized Controlled Trial

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ABSTRACT

Background: Established yoga sequences, such as Surya Namaskar, are largely organized around forward and backward movements. Nakshatra Vinyasa is a new sequence that combines forward, backward, and lateral movement with prescribed breathing. The present study focused on developing it, validating its content, and comparing its effects with Surya Namaskar and a control group.

Methods: Twenty experts holding a Ph.D. in yoga or a sports-related field rated the sequence, and the content validity ratio (CVR) was calculated. In a three-arm randomized trial, 150 healthy students aged 18–25 years (50 per group) were allocated to Nakshatra Vinyasa, Surya Namaskar (45 minutes, six days a week for 45 days) or a waitlist control. Rate–pressure product (RPP), heart rate recovery (HRR) and spirometry (FVC, FEV_1, FEV_1/FVC, PEFR, MVV) were measured before and after. Analysis used paired t-tests and Welch's ANOVA on change scores.

Results: Every item exceeded the critical CVR of 0.42 (mean 0.71). Within groups, Nakshatra Vinyasa improved RPP, HRR, FVC, FEV_1, PEFR and MVV ($p \leq .023$), and Surya Namaskar improved HRR, FVC, FEV_1 and RPP ($p \leq .034$). Change scores differed among groups only for HRR ($p < .001$): gains were greater with Nakshatra Vinyasa (3.14 bpm) and Surya Namaskar (2.56 bpm) than with control (0.66 bpm), with no difference between the two practices.

Conclusion: Nakshatra Vinyasa is a content-valid, practicable sequence. After 45 days, it improved heart rate recovery as much as Surya Namaskar and significantly more than control, and it produced significant within-group improvements in RPP, FVC, FEV_1, PEFR and MVV. These findings support Nakshatra Vinyasa as a promising multidirectional practice for healthy young adults and justify larger trials.

Keywords: Nakshatra Vinyasa; Surya Namaskar; content validity; heart rate recovery

INTRODUCTION

Movement is a fundamental stimulus for building strength. When the body moves against gravity and its own weight, the muscles work against resistance, and repeated weight-bearing and transitions between positions load muscles, tendons, and joints. Standing and weight-bearing yoga postures, for example, produce greater lower-limb muscle activation than seated versions of the same poses (Veneri et al., 2025), and muscle activity during Surya Namaskar is generally greater in

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the transitions between postures than in the held postures (Mullerpatan et al., 2020). Organized sequences of movement are therefore a practical way to deliver whole-body, body-weight resistance.

Many such sequential practices are followed worldwide. Tai Chi and Qigong link slow, continuous movements with weight shifting, postural control and breathing; Tai Chi improves balance-related outcomes in older adults (Chen et al., 2023). Pilates arranges exercises in a fixed order with controlled breathing and has been shown to influence pulmonary and autonomic variables in healthy young women (Adıgüzel et al., 2023). Vinyasa-style flow yoga is practiced internationally, and different Vinyasa sequences elicit distinct metabolic and heart rate responses (Cheruka et al., 2023). In the Indian context, the best-known sequences are Surya Namaskar, Chandra Namaskar and Ashtanga Vinyasa flow.

A good sequential practice moves all the joints dynamically and improves respiration and circulation. These effects depend on how the sequence is constructed, because once postures are linked, the transitions impose demands on muscular coordination, weight transfer, balance, joint mobility, spatial orientation, and timing. A sequence should therefore be judged by its architecture: the number and order of postures, direction of movement, anatomical planes, joint actions, stretching, weight-bearing pattern, balance requirements, breath coordination, repetition, rhythm and transitions, and not only by the postures it contains (Majhi et al., 2026).

Judged in this way, the established sequences differ. Surya Namaskar, the most widely studied Indian sequence (Bandyopadhyay et al., 2025; Mody, 2011; Singh et al., 2025), is organized mainly around repeated forward and backward movements in the sagittal plane, with flexion, extension, and changes in weight-bearing. Chandra Namaskar adds lateral and frontal-plane movement, and Ashtanga Vinyasa links postures through continuous, breath-linked transitions. Even so, the commonly practiced flows still emphasize forward and backward movement. This matters because each direction loads the body differently. Forward movements flex the trunk and hips and lengthen the posterior structures; backward movements extend the spine; lateral movements move the body away from its midline and require asymmetrical loading and trunk and lower-limb control; and rotational and diagonal components further alter the spatial organization. A sequence that deliberately combines forward, backward, and lateral movement and stretching within a single continuous flow would therefore provide a more comprehensive stimulus.

Nakshatra Vinyasa was constructed on this basis. It combines yoga-based postures into a dynamic, flowing sequence that begins from an erect standing "star" position, with a wide stance and extended arms, and then moves through lateral and rotational reaches, side lunges, backward and forward bends, weight-bearing floor-based postures, unilateral lower-limb lunges and a walk-forward return to standing. Inhalation, exhalation, and breath retention are assigned to specific movements, ensuring a consistent respiratory structure and reproducible repetition. The aim in constructing it was not to claim superiority over existing practices, but to create a standardized multidirectional sequence whose structure can be described, validated, and tested.

Gap in the evidence. First, no peer-reviewed empirical study has examined Nakshatra Vinyasa, and there is no standardized, expert-validated protocol that others could reproduce. Second, head-to-head comparisons of two structured sequences under standardized conditions are scarce, as most yoga studies compare a practice with a sedentary or baseline condition. Third, lung function, cardiovascular function, and cognition are usually studied separately, and much of the yoga-cognition evidence comes from older adults, leaving healthy young adults understudied. Content validation shows that the sequence is appropriate and clearly described; it does not show that it is beneficial, so its effects must be tested directly.

Based on this background, the present study aimed (i) to develop and standardize Nakshatra Vinyasa; (ii) to establish its content validity through a panel of 20 yoga experts; and (iii) to compare the effects of 45 days of Nakshatra Vinyasa, Surya Namaskar and a waitlist control on lung function (FVC, FEV_1, PEFR, MVV), and cardiovascular function (rate–pressure product and heart rate recovery) in healthy young adults aged 18–25 years.

METHODS

Study design and ethics

This was a three-arm, parallel-group randomized controlled trial with a waitlist control. Nakshatra Vinyasa (NV) was developed and content-validated before the trial. Participants were assessed at baseline and after 45 days. The study was approved by the Ethics Committee of Desh Bhagat University. All participants gave written informed consent.

Development of Nakshatra Vinyasa

NV was developed as a continuous sequence of lateral, forward, backward, rotational, unilateral and floor-based movements linked to breathing. Construction followed an analysis of the sequence architecture: direction of movement, planes and joint actions, stretching, weight-bearing pattern, balance demands, transitions, breath coordination and rhythm. The sequence starts from a standing star posture and progresses through lateral–rotational reaches and side lunges (steps 1–8), backward and forward bends (9–11), weight-bearing plank, upward-facing and inverted-V postures (12–14), unilateral forward lunges with backbend (15–16), a repeat of the floor sequence (17–19), and a forward walk, fold, backbend and return to standing (20–24). It comprises numbered steps 0–24 (27 items when sub-steps are counted). For each step, the protocol specifies

the procedure, the breath phase (inhale, exhale, or hold), an illustration, and a musculoskeletal and cardiopulmonary rationale. Postures are held for 2–3 seconds with smooth transitions. Each session begins with 2–3 minutes of standing preparation, repeats the full cycle as many times as comfortably fits into 45 minutes with brief rests, and ends with a few minutes of relaxation.

Content validation

Twenty experts, each holding at least a Ph.D. in yoga or a sports-related field [and, if applicable, more than 20 years of experience; state how they were selected], independently rated every item as useful, may be useful, or not useful. The content validity ratio (CVR) was calculated as $(Ne - N/2)/(N/2)$, where Ne is the number of experts who rated the item as useful and $N = 20$ (Lawshe, 1975). Items with CVR ≥ 0.42, the critical value for 20 experts, were retained. The proportion rating each item useful was also computed. All 27 items met the criterion (CVR 0.50–0.80; mean CVR 0.71; mean agreement proportion 0.85). Items were modified on the basis of expert comments [Figure 1]



Participants and sample size

Healthy students of both sexes aged 18–25 years were recruited from [institutions] in Kerala. Inclusion criteria were age 18–25 years, enrolment in an undergraduate or postgraduate program, no yoga, pranayama or meditation practice in the previous six months, general good physical and mental health, and voluntary consent. Exclusion criteria were diagnosed psychiatric conditions, respiratory or cardiac illness, neurological or musculoskeletal disorders limiting participation, and use of medication affecting cognition, mood, or physiology. The target sample was 150 participants (50 per group), based on an a priori power analysis in G*Power 3.1.9.3 (medium effect size $d = 0.5$, $\alpha = .05$, power = .80) with an allowance for 20% attrition [verify calculation].

Randomization and blinding

Participants were randomly allocated to NV, Surya Namaskar (SN), or waitlist control using a computer-generated sequence [state block size and stratification]. An independent researcher handled allocation to ensure concealment. The study was not blinded: participants, the instructor, and the assessors knew the group allocation.

Interventions

NV group: 45-minute supervised sessions, six days a week (Sunday excluded), for 45 days, following the validated protocol. SN group: the same schedule, performing the traditional 12-posture Surya Namaskar (Pranamasana to Hastauttanasana), which was not separately validated as it is a classical sequence, each posture linked to inhalation, exhalation, or breath retention, and repeating rounds as comfortably as possible within 45 minutes. Control group: usual routine with no additional practice. Sessions were led by an expert in both Surya Namaskar and Nakshatra Vinyasa. Attendance and adverse events were recorded.

Outcome measures

Demographic data (age, sex, BMI, education, socioeconomic status and prior yoga experience) were

recorded at baseline. All tests were conducted under standardized laboratory conditions after familiarisation, at baseline and after 45 days.

Lung function was measured with a digital spirometer. Forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), and peak expiratory flow rate (PEFR) were taken as the best of 3 efforts. Maximum voluntary ventilation (MVV) was measured over 12–15 seconds and extrapolated to L/min. Values were interpreted against age-, sex- and height-adjusted reference values.

Cardiovascular function was assessed as the rate–pressure product (heart rate × systolic blood pressure, measured with an automated monitor after 5 minutes of seated rest) and heart rate recovery

Statistical analysis

Data were analyzed using Jamovi (version 28.14). Baseline comparability was examined with one-way ANOVA and chi-square tests. Within-group changes were analyzed with paired t-tests. Differences among the three groups were analyzed by one-way ANOVA on change scores (post-test minus pre-test), with Tukey post hoc comparisons (Games–Howell if variances were unequal; Kruskal–Wallis test if normality was not met). Effect sizes are reported as partial η^2 and Cohen's d. The level of significance was set at $\alpha = .05$.

RESULTS

Participants and baseline. A total of 150 young adults (50 per group) completed the study with no missing data. The groups were similar in age (21.52 ± 2.34, 21.88 ± 2.23 and 21.68 ± 2.08 years), gender, education, height, weight and BMI (all $p > .05$). They differed at baseline in systolic blood pressure ($p = .014$), diastolic blood pressure ($p = .048$), physical activity ($p = .028$) and sports participation ($p = .008$).

Cardiovascular function. In the Nakshatra Vinyasa group, RPP fell from 9.10 ± 1.24 to 8.71 ± 1.42 ($\times 10^3$; $p < .001$) and HRR rose from 21.38 ± 1.95 to 24.52 ± 2.35 bpm ($p < .001$). In the Surya Namaskar group, RPP fell slightly from 8.95 ± 1.37 to 8.75 ± 1.60 ($p = .034$), and HRR rose from 20.44 ± 1.50 to 23.00 ± 1.90 bpm ($p < .001$). The control group's RPP did not change (8.77 to 8.69; $p = .504$), while its HRR rose by 0.66 bpm ($p < .001$). Between the groups, the HRR gain was significantly greater in Nakshatra Vinyasa (3.14 ± 1.32 bpm) and Surya Namaskar (2.56 ± 1.53 bpm) than in control (0.66 ± 1.12 bpm; both $p < .001$), and the two practices did not differ ($p = .111$). The change in RPP did not differ among the groups ($p = .121$).

Lung function. Nakshatra Vinyasa significantly increased FVC (3.65 ± 0.53 to 3.75 ± 0.54 L), FEV_1 (3.00 ± 0.49 to 3.11 ± 0.50 L), PEFR (7.39 ± 1.25 to 7.58 ± 1.22 L/s) and MVV (108.1 ± 23.0 to 111.2 ± 25.7 L/min), with $p \leq .023$, while FEV_1/FVC was unchanged ($p = .107$). Surya Namaskar significantly increased FVC (3.50 ± 0.55 to 3.56 ± 0.57 L; $p = .013$) and FEV_1 (2.85 ± 0.47 to 2.92 ± 0.50 L; $p = .006$) but not FEV_1/FVC, PEFR or MVV. The control group showed no significant change in any spirometric measure ($p \geq .059$). The change scores did not differ significantly among the groups for FVC, FEV_1 ($p = .053$), FEV_1/FVC, PEFR or MVV ($p = .127$–$.475$). Overall, *b*oth practices improved heart rate recovery more than control. Nakshatra Vinyasa produced the most consistent within-group gains, but its advantage over Surya Namaskar and control was not statistically significant for RPP or lung function. [Table 1, 2, and 3]

Table 1. Baseline demographic characteristics of the three groups (n = 50 per group)

Variable	Nakshatra Vinyasa (M ± SD)	Surya Namaskar (M ± SD)	Control (M ± SD)	p
Age (years)	21.52 ± 2.34	21.88 ± 2.23	21.68 ± 2.08	0.733
Height (cm)	167.66 ± 6.67	168.02 ± 7.17	167.14 ± 8.47	0.854
Weight (kg)	62.04 ± 8.91	62.24 ± 9.38	63.25 ± 10.76	0.819
BMI (kg/m²)	21.97 ± 2.03	21.96 ± 2.28	22.60 ± 3.13	0.443
Systolic BP (mmHg)	111.90 ± 3.76	113.90 ± 5.42	115.92 ± 9.75	0.009**
Diastolic BP (mmHg)	71.58 ± 2.92	73.80 ± 4.44	73.14 ± 5.89	0.010*
Gender, n (%)				0.973
Male	29 (58.0)	28 (56.0)	29 (58.0)	
Female	21 (42.0)	22 (44.0)	21 (42.0)	
Education, n (%)				0.830
UG	27 (54.0)	26 (52.0)	24 (48.0)	
PG	23 (46.0)	24 (48.0)	26 (52.0)	
Diet, n (%)				0.190
Vegetarian	10 (20.0)	11 (22.0)	14 (28.0)	
Eggetarian	5 (10.0)	7 (14.0)	12 (24.0)	
Non-Vegetarian	35 (70.0)	32 (64.0)	24 (48.0)	
Physical activity, n (%)				0.028*
Sedentary	15 (30.0)	10 (20.0)	5 (10.0)	
Moderate	19 (38.0)	29 (58.0)	23 (46.0)	
Active	16 (32.0)	11 (22.0)	22 (44.0)	

Sports/exercise, n (%)				0.008**
Yes	27 (54.0)	31 (62.0)	16 (32.0)	
No	23 (46.0)	19 (38.0)	34 (68.0)	

M = Mean; SD = Standard deviation; BP = blood pressure; UG = undergraduate; PG = postgraduate. p values from Welch's one-way ANOVA (continuous variables) and chi-square test (categorical variables). *p < .05; **p < .01. All participants were right-handed rural students who never smoked or used alcohol.

Table 2. Pre-test and post-test values within each group (paired-samples t-test, n = 50 per group)

Variable	Group	Pre-test (M ± SD)	Post-test (M ± SD)	p	d
Rate–pressure product (×10³)	Nakshatra Vinyasa	9.10 ± 1.24	8.71 ± 1.42	<.001***	-0.55
	Surya Namaskar	8.95 ± 1.37	8.75 ± 1.60	0.034*	-0.31
	Control	8.77 ± 1.21	8.69 ± 1.55	0.504	-0.10
Heart rate recovery (bpm)	Nakshatra Vinyasa	21.38 ± 1.95	24.52 ± 2.35	<.001***	2.37
	Surya Namaskar	20.44 ± 1.50	23.00 ± 1.90	<.001***	1.68
	Control	20.34 ± 1.26	21.00 ± 1.88	<.001***	0.59
FVC (L)	Nakshatra Vinyasa	3.65 ± 0.53	3.75 ± 0.54	<.001***	0.78
	Surya Namaskar	3.50 ± 0.55	3.56 ± 0.57	0.013*	0.37
	Control	3.67 ± 0.60	3.70 ± 0.63	0.170	0.20
FEV_1 (L)	Nakshatra Vinyasa	3.00 ± 0.49	3.11 ± 0.50	<.001***	0.81
	Surya Namaskar	2.85 ± 0.47	2.92 ± 0.50	0.006**	0.41
	Control	3.02 ± 0.50	3.04 ± 0.53	0.346	0.13
FEV_1/FVC (%)	Nakshatra Vinyasa	82.28 ± 4.36	82.73 ± 4.90	0.107	0.23
	Surya Namaskar	81.39 ± 3.89	81.79 ± 4.53	0.172	0.20
	Control	82.36 ± 3.62	82.18 ± 4.47	0.503	-0.10
PEFR (L/s)	Nakshatra Vinyasa	7.39 ± 1.25	7.58 ± 1.22	0.003**	0.44
	Surya Namaskar	7.13 ± 1.40	7.18 ± 1.51	0.425	0.11
	Control	6.86 ± 1.41	6.99 ± 1.50	0.059	0.27
MVV (L/min)	Nakshatra Vinyasa	108.1 ± 23.0	111.2 ± 25.7	0.023*	0.33
	Surya Namaskar	110.8 ± 19.2	111.6 ± 21.5	0.541	0.09
	Control	121.4 ± 20.1	123.1 ± 19.8	0.119	0.22

M = Mean; SD = Standard deviation; FVC = forced vital capacity; FEV_1 = forced expiratory volume in one second; PEFR = peak expiratory flow rate; MVV = maximum voluntary ventilation. *p < .05; **p < .01; ***p < .001. Level of significance: α = .05. Cohen's d is the paired-samples effect size (mean difference/SD of differences); a negative value indicates a decrease from pre-test to post-test. The Wilcoxon signed-rank test gave the same conclusions except for Surya Namaskar RPP (p = .060) and Nakshatra Vinyasa FEV_1/FVC (p = .047).

Table 3. Comparison of change scores (post-test minus pre-test) among the three groups

Variable	Nakshatra Vinyasa (M ± SD)	Surya Namaskar (M ± SD)	Control (M ± SD)	Welch F	p	η^2	Post hoc (Games–Howell)
Rate–pressure product (×10³)	-0.39 ± 0.69	-0.20 ± 0.65	-0.08 ± 0.82	2.16	0.121	0.03	None significant
Heart rate recovery (bpm)	3.14 ± 1.32	2.56 ± 1.53	0.66 ± 1.12	56.94	<.001***	0.39	NV vs CT, p < .001; SN vs CT, p < .001
FVC (L)	0.11 ± 0.14	0.06 ± 0.18	0.04 ± 0.20	2.11	0.127	0.03	None significant
FEV_1 (L)	0.10 ± 0.13	0.07 ± 0.16	0.03 ± 0.19	3.02	0.053	0.04	NV vs CT, p = .046
FEV_1/FVC (%)	0.5 ± 2.0	0.4 ± 2.0	-0.2 ± 1.8	1.68	0.192	0.02	None significant
PEFR (L/s)	0.19 ± 0.42	0.05 ± 0.42	0.13 ± 0.47	1.36	0.261	0.02	None significant
MVV (L/min)	3.1 ± 9.4	0.8 ± 9.7	1.6 ± 7.2	0.75	0.475	0.01	None significant

M = Mean; SD = Standard deviation; NV = Nakshatra Vinyasa; SN = Surya Namaskar; CT = Control; η^2 = eta squared. Welch's one-way ANOVA was used on the change scores, with Games–Howell post hoc comparisons. ***p < .001. Because the groups differed at baseline in several variables, a one-way ANCOVA on post-test scores adjusted for baseline was also run; it gave the same conclusions (heart rate recovery: p < .001 with NV and SN > control, NV–SN p = .094; all other outcomes, group effect p > .05). With seven outcomes, a

Bonferroni-adjusted α of .007 would leave only heart rate recovery significant. Level of significance: α = .05.

DISCUSSION

This three-arm trial compared 45 days of Nakshatra Vinyasa, Surya Namaskar, and a no-intervention control in healthy young adults. Both practices increased heart rate recovery (HRR) more than the control, and within the Nakshatra Vinyasa group, RPP fell, and FVC, FEV_1, PEFR and MVV rose significantly. However, change scores in RPP and in all spirometric measures did not differ significantly among the groups, and Nakshatra Vinyasa and Surya Namaskar did not differ from each other in any outcome. The evidence that Nakshatra Vinyasa is more effective than Surya Namaskar or control is therefore limited to HRR, and these findings should be regarded as preliminary.

Heart rate recovery. HRR was the only outcome with a clear between-group effect: the gain was 3.14 bpm with Nakshatra Vinyasa, 2.56 bpm with Surya Namaskar, and 0.66 bpm in the control group, and this remained significant after adjustment for baseline and after Bonferroni correction for seven outcomes. A faster fall in heart rate after exertion is generally taken to reflect quicker restoration of parasympathetic influence, and long-term yoga practitioners have shown greater post-exercise autonomic recovery than aerobic or resistance-trained adults, although that comparison was cross-sectional (Sreenath et al., 2026). The interpretation of HRR depends on the exercise test used and therefore needs to be described precisely. The small rise in the control group (0.66 bpm) may reflect familiarity with the test.

Rate–pressure product. RPP, the product of heart rate and systolic blood pressure, is an indirect index of myocardial workload. It fell significantly within the Nakshatra Vinyasa group ($p < .001$) and less clearly within the Surya Namaskar group ($p = .034$, not significant on the Wilcoxon test), but the change did not differ significantly among the groups. Reductions in heart rate, blood pressure and RPP after yoga have been reported in people with heart failure (Krishna et al., 2014), a population that differs from ours, and the effect of a single session on blood pressure and heart rate depends on when they are measured (Thrower et al., 2023). We therefore cannot conclude that either practice reduced resting cardiac workload more than control.

Lung function. The within-group gains in FVC, FEV_1, PEFR and MVV after Nakshatra Vinyasa are in line with studies in healthy young adults in which yoga practice increased these measures (Parikh et al., 2014) and with reports that breathing practices change spirometric values (Jahan et al., 2020; Tah et al., 2025). Both practices link movement to inhalation, exhalation and breath retention, and repeated forward, backward and lateral movements involve the thorax and trunk, which could increase respiratory muscle use. These explanations were not tested here. Importantly, the gains were modest (about 0.1 L in FVC and FEV_1), the control group also drifted upwards slightly, and the between-group differences were not significant (FEV_1, $p = .053$, with only the Nakshatra Vinyasa–control comparison nominally significant at $p = .046$, which would not survive correction for multiple comparisons). Spirometry depends on effort and familiarity, and improvements after a practice session have been partly attributed to such factors (Kakkar et al., 2025). The group effects may also have been too small to detect with 50 participants per group.

Nakshatra Vinyasa compared with Surya Namaskar. We found no significant difference between the two practices in any outcome, so the data do not show that the multidirectional sequence is superior to Surya Namaskar. The numerical differences favored Nakshatra Vinyasa in most outcomes, which may justify a larger trial. Different yoga sequences vary in their metabolic and heart rate demands (Cheruka et al., 2023; Majhi et al., 2026), and tempo alters the stimulus (Park & Yang, 2023). In our study, the number of rounds and the pace were not matched, so exercise dose may have differed between the practices.

LIMITATIONS

The limitations are that the study was not blinded. The groups differed at baseline in systolic and diastolic blood pressure, physical activity, sports participation, HRR and MVV; although adjusting for baseline did not change the conclusions, residual confounding is possible. Seven outcomes were tested, so some nominal findings may be chance findings. All participants were rural students from one institution, which limits generalisability. Cadence, the number of rounds, and perceived exertion were not recorded, and there was no follow-up after the post-test. Spirometry and HRR are sensitive to effort and test protocol. Finally, Surya Namaskar was not separately validated by experts.

CONCLUSION

Forty-five days of Nakshatra Vinyasa and Surya Namaskar both improved heart rate recovery in healthy young adults compared with the control group, and Nakshatra Vinyasa was followed by within-group improvements in RPP and lung function. Superiority over Surya Namaskar or control was not demonstrated for RPP or spirometry. Future studies should use larger, more diverse samples, equalize doses across sequences, include blinded assessment, standardize the HRR and RPP protocols, and follow participants after the intervention.

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