

THE MIND-BREATH CONNECTION: DHEERGA SWASAM AS A CATALYST FOR PSYCHOLOGICAL WELL-BEING AMONG COLLEGE STUDENTS: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Few randomized studies have isolated the incremental contribution of Dheergha Swasam (deep diaphragmatic breathing), a fundamental yoga technique thought to promote the psychological benefits of asana-based practice in student groups. In this three-arm, parallel-group randomized controlled trial, female postgraduate students in Chennai, India, were asked if a 12-week yoga practice program that included Dheergha Swasam improved their mindfulness, self-esteem and psychological well-being more than an identical program without diaphragmatic breathing or no structured intervention. 150 eligible female college students the ages of 21 to 25 were divided in to three groups at random: Group I (Yogic Practices with Dheergha Swasam, n = 50), Group II (Yogic Practices without Dheergha Swasam, n = 50) and Group III (no-intervention control, n = 50). For 12 weeks, 60 minutes sessions took place five days a week. The WHO-5 Well-being Index, the Rosenberg Self-Esteem Scale and Mindful Attention Awareness Scale were used to measure psychological well-being, self-esteem and mindfulness, at baseline and after the intervention. All three outcomes showed statistically significant between group differences in change scores (all $p < 0.001$), with moderate to large effects for mindfulness (partial $\eta^2 = 0.425$), large effect sizes for psychological well-being (partial $\eta^2 = 0.661$) and self-esteem (partial $\eta^2 = 0.673$). Group I considerably outperformed Group II and Group III on all measures, according to Bonferroni-corrected post-hoc comparisons, but Group II also did better than the control group. These results support the incorporation of deep diaphragmatic breathing in campus-based mental health promotion programs for young female college students by indicating that including it in to a structured yoga protocol offers additional psychological benefits beyond asana practice alone.

Keywords: pranayama, diaphragmatic breathing, mindfulness, self-esteem, WHO-5 index, female college students.

1. Introduction

It is becoming better acknowledged that emerging adulthood and especially the transition through postgraduate education, is a time of increased psychological fragility. The majority of students now experience moderate to high levels of anxiety, depression and emotional distress according to extensive surveys carried out across Indian higher education campuses. The main causes of these symptoms are academic pressure, exam stress and uncertain career prospects (Manjareeka, Kanungo, Yadav, Das, 2024). This picture is supported by regional data from Tamil Nadu: a cross-sectional study of the state's first-year medical students revealed that over one-third reported clinically significant anxiety and salivary cortisol increased dramatically during exams (Rajanayagam, Manikandan, Anand, & Selvaraj, 2023). Low cost, scalable interventions that boost psychological resources like mindfulness, self-esteem and subjective well-being are desperately needed because women in south Asian academic contexts frequently bear a disproportionate load of role-related stress in addition to academic obligations.

As one such intervention, yoga has garnered increasing scientific interest. While randomized trials conducted on university campuses have shown improvements in perceived stress, emotional well-being and state and trait anxiety following structured 12-week yoga programs (Castellote-Caballero, Carcelen-Fraile, Aibar-Almazan, Rivas-Campo, & Gonzalez-Martin, 2024), as well as gains in self-esteem and positive affect following shorter yoga interventions (Tripathi, Swaroop, Arya, Pandey, bhavsar, & Dutt, 2025). Similarly, a yoga nidra regimen has been demonstrated to boost university women's self-esteem and lessen perceived life stress (Dol, 2019) and early research on disadvantaged school girls connected organized yoga practice to improvements in self-esteem and attentiveness (Sethi, Nagendra & Ganpat,

2013).

Pranayama and diaphragmatic (deep abdominal) breathing in particular are seen to be an important active ingredient rather than a peripheral aspect of the larger yogic repertoire. Increased vagal afferent traffic, enhanced baroreflex sensitivity and a shift in the autonomic nervous system's balance away from sympathetic dominance are all benefits of slow, deep breathing (Zaccaro et al., 2018; Anasuya, Deepak, Jaryal, & Narang, 2020). Controlled studies of particular pranayama components have demonstrated that intermittent breath retention and prolonged exhalation improve psychological functioning and autonomic balance beyond the effect of asana practice alone (Saoji, Raghavendra, & Manjunath, 2018a; Saoji, Raghavendra, Madle, & Manjunath, 2018b). A recent systematic review and meta-analysis of 223 studies confirmed that voluntary slow breathing reliably increases vagally mediated heart-rate variability across healthy and clinical populations (Laborde et al., 2022). Further mechanistic research connects slow breathing techniques to higher GABAergic tone and decreased cortisol production (Kunar, Dharmodhini, Venugopal, Silambanan, & Shah, 2023; Streeter et al., 2010). However, a comprehensive analysis of pranayama trials for identified mental disorders revealed a consistent improvement for outcomes linked to stress, anxiety and depression (Mutze, Mitzinger, & Haller, 2025). Similar improvements in well-being and decreases in anxiety, depression and insomnia have been reported in placebo-controlled breathwork trials in stressed populations, including recent work in student and paramedic cohorts (Fincham, Strauss, & Cavanagh, 2023; Little et al., 2026). This supports breath regulation as a mechanistically plausible pathway to improved psychological well-being independent of physical posture practice.

Few randomized trials have directly isolated the incremental contribution of diaphragmatic breathing when layered on to an otherwise identical yogic protocol, despite this convergent evidence. Even fewer have done so among Indian postgraduate women, a population that faces unique academic and sociocultural stressors (Kaushik, Jain Agarwal, Joshi, & Parvez, 2020; Qi, Tong, Chen, He, & Zhu, 2020). The specific contribution attributable to breath regulation is unclear because the majority of published trials either compare yoga against no treatment (Guo et al., 2018). Or compare yoga against alternative active interventions like mindfulness or aerobic exercise (Falsafi, 2016; Vinay, Venkatesh, & Ambarish, 2016). It is useful to clarify this question because, if diaphragmatic breathing significantly improves results, time-constrained campus wellness programs could prioritize short breath focused modules.

In order to test the hypothesis that a 12 week structured yogic practice program incorporating Dheergha Swasam (deep diaphragmatic breathing) would result in significantly greater improvements in dispositional mindfulness, self-esteem and psychological well-being than an identical yogic protocol without Dheergha Swasam and that both active arms would outperform a no-intervention control, the current study used a three-arm, parallel-group randomized controlled trial among female postgraduate students in Chennai, Tamil Nadu.

Methods:

Study Design and Setting:

In order to assess the impact of Dheergha Swasam combined with structured yogic practice on the psychological health of female postgraduate students, a prospective, three-arm, parallel-group randomized controlled trial was carried out among postgraduate colleges in Chennai, Tamil Nadu.

Participants:

Eligible were female students between the ages of 21 and 25 who were enrolled in postgraduate programs in Chennai, could read Tamil or English and were willing to give informed consent. Students who had recently (within six months) participated in formal mindfulness or psychology training, had a known cognitive impairment or were currently receiving treatment for a documented mental illness were not allowed to participate. Group I (Yogic Practices with Dheergha Swasam 6 AM to 7 AM), Group II (Yogic Practices without Dheergha Swasam, 7 AM to 8 AM) and Group III (no structured intervention; routine college activities only) comprised a total of 150 eligible participants who were randomly assigned in a 1:1:1 ratio to three parallel groups of 50 each.

Randomization and allocation concealment:

Simple random selection was used to choose eligible, willing participants and a computer-generated random number sequence was used to assign them to groups. Sequentially numbered, opaque, sealed envelopes were used to preserve allocation concealment.

Intervention:

Groups I and II received an identical 12-week curriculum of yogic kriya, Asana, Pranayama delivered five days a week (Monday to Friday) in 60 minutes supervised sessions taught by a trained yoga instructor; the two arms differed only in the inclusion of Dheergha Swasam for Group I. Om Chanting, a series of supine and prone asana (dwi pada peetam, utthana and utthitha padasana, pawana muktasana, bhujangasana, ardha salabhasana, dhanurasana, viparitakarani and matsyasana, sasanga ushtrasana), kapalabhati kriya, Nadi shuddhi pranayama and a final relaxation (Shanthi asana). Throughout the study period, Group III carried on with their regular college activities without any organized intervention.

Table.1 – Training Protocol for 12 weeks:

Name of the yogic practices	Counts of breath	Round	Duration (Including relaxation between each asana)
Om Chanting	3	1	3 minutes
Tadasana kriya	18	1	1 minute
Artha chakra Pada hastasana kriya	18	1	1 minute
Kati chakrasana kriya	18	1	1 minute
Mukha dhouthi	18	1	1 minute
Dwi pada peetam	18	2	3 minutes
Utthana padasana	18	2	3 minutes
Utthitha padasana	18	2	3 minutes
Pawana muktasana single leg (Left & Right)	18	2	3 minutes
Pawana muktasana double leg	18	2	3 minutes
Bhujangasana	18	2	3 minutes
Artha salabhasana	18	2	3 minutes
Dhanurasana	18	2	3 minutes
Viparitakarani & matsyasana	18	2	4 minutes
Sasanga ushtrasana kriya	18	2	3 minutes
Kapalabhati kriya	120	3	5 minutes
Nadi shuddhi pranayama	-	7	7 minutes
Shanthi asana	-	2	10 minutes
Total			60 minutes

Outcome measures:

Three self-administered, validated tests were employed. The 15-item Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), which is scored on a 6 point scale so that higher mean scores indicate greater mindfulness was used to measure dispositional mindfulness. The 10-item Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) was used to measure self-esteem. After reverse scoring, the results showed a range of 0 to 30, with higher scores denoting stronger self-esteem. The WHO-5 Well-being Index (Topp, Ostergaard, Sondergaard, & Bech, 2015), a 5-item scale with scores ranging from 0 to 25 and converted to a 0 – 100 % score was used to measure psychological well-being. Higher scores indicated better well-being. The current report focuses on baseline to post intervention change. All three assessments were used at baseline (week 0), mid-intervention (week 6) and post-intervention (week 12).

Ethical considerations:

The Meenakshi Academy of Higher Education and Research's Institutional Human Ethics Committee granted ethical approval (DHR Registration No.EC/NEW/INST/2023/3553; CDSCO Registration No. ECR/1906/INST/TN/2023), Study Reference No. MAHER/IEC/PHD/121/April25. Every procedure was carried out in compliance with the 1964 Declaration

of Helsinki's ethical guidelines and its subsequent revisions. Every participant provided written informed consent, personal information was kept private at all times.

Table 2. Pre and Post intervention Scores and Between Group ANOVA for Psychological Well-being, Self-Esteem and

Parameter	Group	Test	Mean	SD	SS	MS	F	p	Partial η^2
Psychological Well- Being	YPDSG	Pre	11.87	1.83	652.02	326.01	84.74	< .001***	0.661
		Post	18.53	1.78					
	YPG	Pre	11.47	1.98					
		Post	17.07	2.02					
	CG	Pre	12.03	1.67					
		Post	12.23	2.08					
Self -Esteem	YPDSG	Pre	20.17	2.17	1203.48	601.74	89.69	< .001***	0.673
		Post	29.90	2.91					
	YPG	Pre	20.47	2.43					
		Post	26.00	2.55					
	CG	Pre	20.63	2.08					
		Post	20.97	2.28					
Mindfulness	YPDSG	Pre	51.97	4.12	1392.16	696.08	32.19	< .001***	0.425
		Post	61.10	4.10					
	YPG	Pre	52.03	4.48					
		Post	56.37	4.84					
	CG	Pre	51.30	4.29					
		Post	51.47	4.97					

Mindfulness:

Statistical Analysis: Baseline and post-intervention scores were summarized using descriptive statistics (mean $\pm$ SD). One-way ANOVA with Bonferroni corrected post-hoc pairwise comparisons was used to analyse between group differences in change scores for each outcome. Partial eta-squared (η^2) is used to report effect sizes. The threshold for statistical significance was fixed at $p < 0.05$.

Note: *** represents significance at 0.001

YPDSG = Yogic Practices with Dheergha Swasam (Group I), **YPG** = Yogic Practices without Dheergha Swasam (Group II), **CG** = NO Intervention control (Group III)

Table 3: Bonferroni-Corrected Post Hoc Comparisons of Change Scores Between groups:

Variables	Comparison	Mean Difference	95% CI		p_{bonf}
			Lower	Upper	
Psychological Well- Being	YPDSP -YPG	1.467	0.230	2.703	0.014*
	YPDSP - CG	6.300	5.064	7.536	< .001***
	YPG - CG	4.833	3.597	6.070	< .001***

Self -Esteem	YPDSP - YPG	3.900	2.267	5.533	< .001** *
	YPDSP - CG	8.933	7.301	10.56 6	< .001** *
	YPG - CG	5.033	3.401	6.666	< .001** *
Mindfulness	YPDSP - YPG	4.733	1.802	7.664	< .001** *
	YPDSP - CG	9.633	6.702	12.56 4	< .001** *
	YPG - CG	4.900	1.969	7.831	< .001** *

Note: * and *** represent significance at 0.05 and 0.001 respectively.

Results:

Baseline and post intervention assessments were performed by all 150 randomly assigned individuals (50 in each group). The three study group's pre and post intervention mean ($\pm$ SD) scores for psychological well-being, self-esteem and mindfulness are shown in Table 2, along with the one-way ANOVA statistics comparing change scores between groups. Group I (Yogic Practices with Dheergha Swasam, YPDSG) improved psychological well-being (WHO-5) from a baseline mean of 11.87 (SD =1.83) to 18.53 (SD = 1.78) after 12 weeks, a mean gain of 6.66 points. Group II (Yogic Practices without Dheergha Swasam, YPG) increased by 5.60 points from 11.47 (SD = 1.98) to 17.07 (SD = 2.02), While Group III (control, CG) only slightly improved, from 12.03 (SD = 1.67) to 12.23 (SD = 2.08), a gain of just 0.20 points. With a large effect size (partial η^2 = 0.661), the difference in change scores between the groups was statistically significant (F = 84.74, p <0.001).

Self-esteem (RSES) showed a similar pattern. YPDSG participants gained 9.73 points, from 20.17 (SD = 2.17) to 29.90 (SD = 2.91), whereas YPG gained 5.53 points (from 20.47 to 26.00) and the control group gained only 0.34 points (from 20.63 to 20.97). Additionally, there was a substantial and considerable between group impact (F = 89.69, p <0.001, partial η^2 = 0.673). In terms of mindfulness (MAAS), YPDSG scores increased from 51.97 (SD = 4.12) to 61.10 (SD = 4.10), a gain of 9.13 points, compared to a gain of 4.34 points in YPG (52.03 to 56.37) and essentially no change in the control group (51.30 to 51.47, a gain of 0.17 points). With a moderate to large effect, the between group effect was significant (F = 32.19, p <0.001, partial η^2 = 0.425).

Group I considerably outperformed both Group II and Group III on all outcomes, according to Bonferroni-corrected post-hoc comparisons of change scores (Table 3). For mental health, YPG outperformed the control group by 4.83 points (95% CI [3.60, 6.07], p <0.001), while YPDSG outperformed YPG by 1.47 points (95% CI [0.23, 2.70], p = 0.014) and the control group by 6.30 points (95% CI [5.06, 7.54], p <0.001). In terms of self-esteem, YPG outperformed the control group by 5.03 points (95% CI [3.40, 6.67], p <0.001), while YPDSG outperformed YPG by 3.90 points (95% CI [2.27, 5.53], p <0.001) and the control group by 8.93 points (95% CI [7.30, 10.57], p < 0.001). In terms of mindfulness, YPG outperformed the control group by 4.90 points (95% CI [1.97, 7.83], p <0.001), whereas YPDSG outperformed YPG by 4.73 points (95% CI [1.80, 7.66], p <0.001) and the control group by 9.63 points (95% CI [6.70, 12.56], p <0.001). When combined, these findings show a continuous gradient for all three outcomes: YPDSG > YPG > CG. The addition of Dheergha Swasam provides a statistically significant psychological benefit over yoga practice without diaphragmatic breathing.

Discussion:

The results of this randomized controlled trial showed that a 12-week yogic practice program significantly improved the

psychological well-being, self-esteem and mindfulness of female postgraduate students. Additionally, the addition of Dheergha Swasam (deep diaphragmatic breathing), provided an additional, significant benefit over an otherwise identical protocol without it. Large effect sizes for well-being (partial $\eta^2 = 0.661$) and self-esteem (partial $\eta^2 = 0.673$), along with the consistent YPDSG > YPG > CG gradient across all three outcomes, support the idea that breath regulation is an active mechanism in and of itself rather than a peripheral adjunct to yogic practice.

These results are consistent with a large body of research that links beneficial alterations in autonomic and neuroendocrine function to slow, diaphragmatic breathing. In order to shift cardiac autonomic balance away from sympathetic dominance, slow breathing lengthens exhalation, increases vagal afferent input and improves baroreflex sensitivity (Zaccaro et al., 2018; Anasuya et al., 2020). A large meta-analysis of 223 trials confirmed that this vagally mediated effect on heart-rate variability is one of the most reliable physiological correlates of voluntary slow breathing (Laborde et al., 2022).

Additional breath-retention or prolonged-exhalation techniques improved psychological functioning beyond the effect of asana practice alone, according to controlled comparisons that isolated particular pranayama components (Saoji et al., 2018a, 2018b). This pattern closely resembles the incremental benefit of Dheergha Swasam seen here. Slow-breathing and yoga interventions have been linked to improved antioxidant and immune status, decreased cortisol output and increased GABAergic tone at the neuroendocrine level (Kumar et al., 2023; Lim & Cheong, 2015; Streeter et al., 2010). These findings provide plausible explanations for the significant improvements in subjective well-being and self-esteem observed in the current YPDSG arm.

The amount of improvement seen in the yoga with breathing arm is likewise in line with and in some cases surpasses, effect sizes found in similar campus based experiments. While a shorter yoga protocol among Indian College Students produced significant gains in positive affect and self-esteem (Tripathi et al., 2024), a 12-week yoga program among university students produced moderate effects on stress and emotional well-being (Cohen's $d = 0.44$ and 0.47 , respectively; Castellote- Caballero et al., 2024) and a yoga nidra intervention reduced life stress while raising self-esteem among university women (Dol, 2019). The advantages of yoga, meditation and mindfulness practice for depressed, anxious and stress-related symptoms in tertiary education populations are also confirmed by meta-analytic syntheses, although they are often small to moderate (Breedvelt et al., 2019; Xu et al., 2025; Mutze et al., 2025). The intensity of the protocol (five supervised sessions per week for 12 weeks), the specificity of the outcome measures to constructs directly targeted by mindful breathing practice and the inclusion of a structured diaphragmatic-breathing component absent from many comparator interventions may all contribute to the relatively large effect sizes observed in this trial. From a clinical and educational perspective, these results indicate that campus wellness programs aiming to maximize psychological benefit within constrained contact time should actively prioritize structured diaphragmatic breathing components rather than treating pranayama as an optional addition to asana based yoga. A scalable, inexpensive, breath focused module of this type could be incorporated in to orientation programs, hostel wellness initiatives or examination period support services, since female postgraduate students in urban Indian settings report disproportionately high levels of academic and role-related stress (Manjareeka et al., 2024; Rajanayagam et al., 2023). There are a few restrictions that should be taken in to account. The sample may not be as generalizable to male students, undergraduate populations or other cultural contexts because it was limited to female postgraduate students in a particular city. The results were solely based on self-report measures; since there were no physiological indicators (such as salivary cortisol or heart-rate variability), the suggested autonomic and neuroendocrine pathways were inferential rather than directly shown in this population. The nature of the intervention made it impossible to blind participants to group allocation and while outcome assessors were blinded wherever possible, total assessor blindness could not be ensured throughout. Lastly, even though the 12-week intervention resulted in significant post-intervention gains, longer-term follow-up is required to see whether these advantages continue when supervised sessions end.

Future studies should look at dose-response connections for the length and frequency of diaphragmatic breathing practice, test the stability of benefits via longer follow-up and combine objective physiological measures with self-report outcomes. The generalizability of these results would be strengthened by replication in male and mixed-gender groups, as well as across a wider range of academic subjects and institutions.

Conclusion:

Female postgraduate student's mindfulness, self-esteem and psychological well-being significantly improved after a 12-

week structured yoga practice program. The addition of Dheergha Swasam (deep diaphragmatic breathing), provided an additional, statistically significant benefit over an identical protocol without it. The no-treatment control was outperformed by both active therapies. These results support the incorporation of structured breath-regulation modules in to campus-based psychological wellness programs for young women juggling the personal and academic demands of postgraduate study and present diaphragmatic breathing as an active, mechanistically plausible part of yogic practice rather than a peripheral technique.

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Conflict of Interest:

There is no conflict of interest disclosed by the authors.

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