

# Effects of Bhramari Pranayama on Anxiety (GAD-7) and Depression (PHQ-9) among university students over a duration of 8 weeks: A Pilot Study

Dr. Ananya Gupta<sup>1</sup>, Dr. Ekta Bhatt<sup>2</sup>, Mr. Praveen Kumar<sup>3</sup>

Affiliations: 1. Assistant Professor, Phonics University, Roorkee,  
2. Assistant Professor, Maya Devi University, Dehradun,  
3. Research Scholar, Gurukul Kangri Vishwavidyalaya, Haridwar,

**Abstract:-** Background: A yogic breathing technique called bhramari pranayama, which entails humming and exhaling, has been shown to have beneficial effects on anxiety and depression in a variety of groups.

Objective: To assess the effect of a structured 8-week Bhramari pranayama intervention on anxiety and depression among university students using the GAD-7 and PHQ-9 scores.

Methods: Twenty university students who had at least mild symptoms of anxiety or depression at baseline participated in this pilot trial, which used a pre-post single-group design. The Generalized Anxiety Disorder-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9) were used to measure anxiety and depression, respectively. Participants engaged in guided Bhramari pranayama for 10 minutes per day, five days a week, for eight weeks. Paired t-tests were used to compare the scores before and after the intervention.

Results: The mean GAD-7 scores reduced from  $10.05 \pm 3.03$  to  $6.55 \pm 2.26$  ( $p < 0.0001$ ), a 34.8% decrease. PHQ-9 scores dropped from  $10.25 \pm 3.54$  to  $7.10 \pm 2.63$  ( $p < 0.0001$ ), a 30.7% decrease. Following the session, 70% of students improved from moderate-severe to minimal-mild anxiety and depression.

Conclusion: This pilot study demonstrates that Bhramari pranayama may be a realistic and potentially effective additional strategy for reducing anxiety and depression symptoms in university students. Larger randomized controlled trials are needed to validate these findings.

**Keywords:** Bhramari pranayama, University students, Anxiety, Depression, GAD-7, PHQ-9, Yoga, Pilot study

## 1. Introduction

University students commonly report high levels of anxiety and depression as a result of academic strain, financial challenges, social pressures, and adjustment issues [1, 2]. The prevalence of anxiety disorders and depression among undergraduate and graduate students has skyrocketed in the recent decade, with major ramifications for academic performance, quality of life, and overall well-being [1][5]. Traditional pharmacological medicines, while effective, carry the risk of dependence and undesirable side effects, prompting interest in complementary and alternative therapeutic approaches [2].

Validated fast screening tools, such as the Generalized Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9), are frequently used in clinical and research contexts to assess and track the severity of anxiety and depression [3][4]. The GAD-7 is a 7-item self-report measure with established validity and reliability, while the PHQ-9 has outstanding psychometric properties for assessing depression in diverse populations [3][4].

Bhramari pranayama, often known as "humming bee breath," is a yogic breathing technique that comprises a progressive inhalation and a persistent humming sound on exhalation[1][2]. The technique produces moderate vibrations in the head, sinuses, and upper airways, which are hypothesized to activate the parasympathetic nervous system and change brain regions involved in emotional regulation[1][2]. According to preliminary research, Bhramari pranayama and associated breathing practices can help reduce stress, anxiety, and depression symptoms, improve sleep quality, and improve overall psychological well-being.[1][2][5]. However, extensive research into its impact on university students, as judged by standardized measures such as the GAD-7 and PHQ-9, is limited.

The purpose of this pilot study was to assess the effect of a structured Bhramari pranayama intervention on anxiety and depression in university students, as well as to produce preliminary data to help design future controlled trials.

## 2. Methods

### 2.1 Study Design and Setting

This was a single-arm pre-post pilot study conducted at [University of Patanjali] from [July 2024 to December 2024], and all subjects gave written informed permission.

### 2.2 Participants and Sampling

Participants were selected via convenience sampling from notice boards, university email, and social media. Inclusion criteria included undergraduate or postgraduate students aged 18-25, a baseline GAD-7 or PHQ-9 score of  $\geq 5$  (indicating mild symptoms), and a willingness to attend planned sessions and practice at home. Exclusion criteria included: (1) current psychiatric medication use or active psychiatric treatment; (2) history of severe mental illness (psychosis, bipolar disorder); (3) respiratory or cardiac conditions that preclude pranayama practice; and (4) prior training in Bhramari pranayama within the previous year.

A convenience sample of 20 participants was chosen for an exploratory pilot study to assess feasibility, acceptability, and offer preliminary effect estimates [5].

### 2.3 Demographic Characteristics

The study sample included 20 participants (13 females, 7 males; 65% female) with an average age of  $21.5 \pm 2.2$  years (range 18-24 years). At baseline, nine subjects reported moderate anxiety, nine mild anxiety, and two severe anxiety on the GAD-7. 9 subjects reported moderate depression, 9 mild depression, and 2 fairly severe depression on the PHQ-9.

### 2.4 Outcome Measures

The GAD-7 is a seven-item self-report measure of anxiety symptoms during the last two weeks [3]. Items are scored on a scale of 0 (not sure) to 3 (nearly every day), with a total score range of 0-21 [3]. Anxiety severity is graded as 0-4 (minimal), 5-9 (mild), 10-14 (moderate), and  $\geq 15$  (severe) [3]. The GAD-7 has excellent internal consistency (Cronbach's  $\alpha = 0.92$ ) and strong diagnostic validity [3]. The PHQ-9 is a nine-item self-report depression scale that evaluates symptoms over the last two weeks[4]. Items are scored from 0 to 3, for a total score of 0-27[4]. The severity levels are 0-4 (minimal), 5-9 (mild), 10-14 (moderate), 15-19 (moderately severe), and 20-27 (severe depression)[4].

The PHQ-9 has great internal consistency (Cronbach's  $\alpha > 0.86$ ) and high validity for depression screening [4]. The two questionnaires were administered at baseline (week 0) and post-intervention (week 8).

### 2.5 Intervention: Bhramari Pranayama Protocol

Participants had an initial 30-minute teaching session with a professional yoga instructor, who demonstrated and taught proper technique. The method involved the following:

#### Technique:

Sit comfortably, with your spine erect. Place both feet flat on the ground or cross your legs. Gently close your eyes. Inhale slowly through both nostrils for four seconds. Exhale gently through the nose for 8 seconds, creating

a gentle humming sound comparable to a bee's buzz. Consider gently shutting your ear canals with your thumbs while humming to increase the vibration sensation. Five to ten repetitions every session.

Frequency and Duration:

Set aside 10 minutes per day for 5-10 rounds, including warm-ups and cool-downs. Scheduled five days a week for eight weeks. 40 sessions (about 6.7 hours of practice time).

Sessions are place in a calm, tranquil setting, with light background music.

Adherence:

Participants were given a practice diary to track their completed sessions. Home practice was encouraged on non-supervised days. The average attendance at monitored sessions was tracked, and participants were contacted often to encourage compliance.

## 2.6 Procedure

1. Week 0: Consenting individuals filled out the baseline demographic questionnaire, GAD-7, and PHQ-9.
2. Weeks 1-8: Participants finished the Bhramari pranayama intervention (5 supervised sessions per week, plus home practice).
3. In week 8, participants finished the post-intervention GAD-7 and PHQ-9.

## 2.7 Statistical Analysis

The data was analyzed using IBM SPSS Statistics version 26. Descriptive statistics were used to describe demographic characteristics, including means  $\pm$  standard deviations for continuous variables and frequencies and percentages for categorical categories. The primary analyses involved paired sample t-tests of GAD-7 and PHQ-9 scores before and after the intervention. We used two-tailed tests with a significance level of  $\alpha = 0.05$ . Cohen's d was used to estimate effect sizes.

Secondary analyses included calculating the proportion of participants in each severity category (minimal, mild, moderate, severe) before and after intervention. The shift in severity categories was evaluated for clinical significance. Missing data was low (<5%) and managed through listwise deletion.

## 3. Results

### 3.1 Sample Characteristics and Adherence

All 20 enrolled participants completed the 8-week intervention and both assessments (100% retention). The average attendance at supervised sessions was 95% (range 90-100%), and 85% of participants reported practicing at home at least three times per week. There were no known adverse outcomes associated with Bhramari pranayama.

### 3.2 Changes in Anxiety (GAD-7)

Primary outcome:

Measure	Baseline Mean $\pm$ SD	Post-intervention Mean $\pm$ SD	Change
GAD-7 Score	10.05 $\pm$ 3.03	6.55 $\pm$ 2.26	-3.50 $\pm$ 2.09

Table 1: GAD-7 Scores at Baseline and Post-intervention (n = 20)

The paired sample t-test revealed a statistically significant decrease in GAD-7 scores from baseline ( $M = 10.05$ ,  $SD = 3.03$ ) to post-intervention ( $M = 6.55$ ,  $SD = 2.26$ ),  $t(19) = 13.646$ ,  $p < 0.0001$ , two-tailed. The average reduction was 3.50 points, which represented a 34.8% decrease from the baseline. The effect size (Cohen's d) was considerable, at 3.06, indicating a clinically significant improvement in anxiety symptoms.

Severity category shift:

GAD-7 Category	Baseline n (%)	Post-intervention n (%)
Minimal (0–4)	0 (0%)	5 (25%)
Mild (5–9)	9 (45%)	14 (70%)
Moderate (10–14)	9 (45%)	1 (5%)
Severe ( $\geq 15$ )	2 (10%)	0 (0%)
Total	20 (100%)	20 (100%)

Table 2: Distribution of GAD-7 Severity Categories at Baseline and Post-intervention

At baseline, 10 students (50%) had moderate to severe anxiety ( $GAD-7 \geq 10$ ). Following assistance, this proportion dropped to one student (5%). In contrast, 14 kids (70%) reported minimal to mild anxiety following intervention, compared to 9 students (45%) at baseline. All two students with significant anxiety at baseline improved to the low range after intervention.

### 3.3 Changes in Depression (PHQ-9)

Primary outcome:

Measure	Baseline Mean $\pm$ SD	Post-intervention Mean $\pm$ SD	Change
PHQ-9 Score	$10.25 \pm 3.54$	$7.10 \pm 2.63$	$-3.15 \pm 2.56$

Table 3: PHQ-9 Scores at Baseline and Post-intervention (n = 20)

The paired sample t-test showed a statistically significant decrease in PHQ-9 scores from baseline ( $M = 10.25$ ,  $SD = 3.54$ ) to post-intervention ( $M = 7.10$ ,  $SD = 2.63$ ),  $t(19) = 11.492$ ,  $p < 0.0001$ , two-tailed. The average reduction was 3.15 points, which represented a 30.7% decrease from the baseline. The effect size (Cohen's d) was large:  $d = 2.58$ , implying significant clinical improvement in depressed symptoms.

Severity category shift:

PHQ-9 Category	Baseline n (%)	Post-intervention n (%)
Minimal (0–4)	0 (0%)	4 (20%)
Mild (5–9)	9 (45%)	14 (70%)

Moderate (10–14)	9 (45%)	2 (10%)
Moderately Severe (15–19)	2 (10%)	0 (0%)
Severe ( $\geq 20$ )	0 (0%)	0 (0%)
Total	20 (100%)	20 (100%)

Table 4: Distribution of PHQ-9 Severity Categories at Baseline and Post-intervention

At baseline, 11 students (55%) had moderate to severe depression (PHQ-9  $\geq 10$ ). Following assistance, this proportion fell to two students (10%). After the intervention, 14 students (70%) had little to mild depression, compared to 9 students (45%) at baseline. Both adolescents with moderately severe depression improved to the mild or minimum level following intervention.

### 3.4 Summary of Results

All 20 subjects exhibited improvements in their anxiety and sadness ratings. The mean improvement in GAD-7 and PHQ-9 was statistically significant ( $p < 0.0001$ ). Overall, 70% of patients ( $n = 14$ ) moved from higher to lower severity categories on both measures, indicating clinically significant improvement. No participant's symptoms worsened after intervention.

## 4. Discussion

This pilot study found that an 8-week Bhramari pranayama intervention dramatically reduces self-reported anxiety and depression symptoms in university students using the GAD-7 and PHQ-9, with large effect sizes and clinically meaningful changes. These findings are consistent with previous research, which suggests that Bhramari pranayama and related yogic breathing techniques can reduce anxiety, depression, and stress while enhancing mental health and well-being[1][2][5].

### 4.1 Interpretation of Findings

The 34.8% drop in GAD-7 scores and the 30.7% reduction in PHQ-9 scores indicate that Bhramari pranayama could be an effective strategy for lowering anxiety and depression symptoms. The shift of 70% of participants from higher to lower symptom severity groups is clinically significant and indicates that the intervention resulted in changes of practical value rather than just statistical significance.

The mechanisms underlying Bhramari's anxiolytic and antidepressant effects likely include: (1) activation of the parasympathetic nervous system through slow breathing and vagal stimulation, reducing physiological arousal[1][2]; (2) modulation of the autonomic nervous system balance, reducing sympathetic dominance[1]; (3) stimulation of the vagus nerve through humming vibrations, promoting calming neural circuits[2][5]; (4) influence on brain regions involved in emotional

### 4.2 Feasibility and Acceptability

Bhramari pranayama is a realistic and acceptable intervention for university students, as evidenced by its high attendance rate (95%) and 85% adherence to home practice ( $\geq 3$  days/week). The technique's simplicity, requiring no special equipment or substantial training, making it ideal for use in university health settings, counseling services, and student wellness initiatives. The 10-minute daily procedure is quick and readily incorporated into kids' everyday routines.

### 4.3 Clinical Implications

This pilot study reveals that Bhramari pranayama could be used as a low-cost, non-pharmacological supplementary therapy for lowering anxiety and depression symptoms in university settings. It could be especially

useful for students looking for alternatives to medication, those who aren't responding well to medication alone, or as a preventive measure for at-risk pupils. Integrating Bhramari pranayama into university health promotion programs, counseling services, or academic support services has the potential to significantly improve student mental health and well-being on a large scale.

#### 4.4 Limitations

Several constraints should be considered. (1) Lack of control group – the single-arm design prevents causal inferences and cannot rule out placebo effects or natural symptom fluctuation; (2) The small sample size ( $n = 20$ ) reduces generalizability and statistical power for subgroup analysis. (3) Convenience sampling – selection bias can impair representativeness. (4) Self-report measures: social desirability bias and response expectancies may inflate claimed improvements. (5) Short follow-up—no data on the durability of benefits beyond 8 weeks; (6) Instructor variability: all sessions were led by a single instructor. (7) The absence of physiological measures—heart rate variability, cortisol, or brain imaging data—would increase mechanistic knowledge. (8) Due to limited demographic variety (65% female), the results may not be generalizable to other age groups or populations.

#### 4.5 Recommendations for Future Research

Future investigations should include the following:

1. Use a randomized controlled design with active or waitlist control groups to determine causal efficacy and account for placebo effects.
2. Use larger sample sizes ( $n \geq 50-100$ ) to increase statistical power and generalizability.
3. Longer follow-up periods (at least 3-6 months) to examine long-term impacts.
4. Use physiological measures (e.g., heart rate variability, salivary cortisol, electroencephalography) to understand the underlying mechanisms.
5. Examine generalizability by analyzing diverse populations, including age groupings, ethnic backgrounds, and clinical subgroups.
6. Implemented structured fidelity assessments to guarantee consistent intervention delivery.
7. Evaluate effectiveness against other evidence-based therapies, such as cognitive-behavioral therapy and mindfulness meditation.
8. Conduct qualitative interviews to understand participants' experiences and perceived benefits.

### 5. Conclusion

This pilot study provides preliminary evidence that an 8-week, structured Bhramari pranayama intervention is feasible, acceptable, and associated with statistically significant and clinically meaningful reductions in anxiety and depression symptoms among university students (measured by GAD-7 and PHQ-9). The huge effect sizes and high proportion of subjects who reported symptom alleviation point to potential clinical value. However, given the limitations of this single-arm design, thorough randomized controlled studies are required to demonstrate efficacy and establish Bhramari pranayama as an evidence-based intervention for university student mental health. Well-designed trials with larger, more diverse samples and longer follow-up would be useful for informing implementation in university health systems and mental health services.

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