International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 13 Issue: 03 | Mar 2026 www.irjet.net p-ISSN: 2395-0072
National Conference on "PRANAYAMA BHARAT-2026"
Organized by: Scientific Pranayama Foundation Trust® Mysuru, in collaboration with ATME College of Engineering, Mysuru.

IMPACT OF SCIENTIFIC PRANAYAMA ON VOCAL ENHANCEMENT AND ACOUSTICS IN SINGERS

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Abstract - *Yoga, in particular Pranayama (conscious breathing), is becoming increasingly popular in the modern world because it has demonstrated numerous beneficial health effects. Understanding and experiencing Pranayama are inextricably intertwined. Studies examining the isolated impact of pranayama on enhancing voice parameters in Singers are currently lacking. This study aimed to create and validate a wide-ranging model of incremental improvement in voice parameters and the positive impact of practicing scientific Pranayama on the vocal enhancement and acoustics in Singers. Pranayama breathing helps to recharge the cells in the vocal cord - energizes the brain cells; thus, the vocal cord cells are rejuvenated, and voice modulation is enhanced. These life-changing scientific Pranayama breathing exercises have helped many in achieving better physical health and positive mental well-being. An experimental individual case-study design was employed, incorporating a rigorous pre-post evaluation. This research targeted both students and adults, utilizing pre- and post-Pranayama voice recordings along with participant feedback as the primary data collection tools. Using a mixed-methods design, the current study uses both numerical data and descriptive analysis to provide a detailed assessment of the proposed vocal health enhancement framework [1]. This study highlights how cultivating a positive mindset combined with regular practice of Pranayama techniques can enhance overall well-being for singers and other professionals who rely heavily on their voice for work.*

*A **comparative analysis** was conducted using **Praat** (version 6.4.01) in a speech laboratory, and expert opinions were solicited in the field of Carnatic music to validate the findings. The results were recorded and analyzed before concluding. The deeper one journeys into the practice of Pranayama, the more one uncovers the vast potential gifted by **Mother Nature** to humanity. When I delve into the teachings of the **Bhagavad Gita** and contemplate the divine origin of **Pranayama**, everything else seems so superfluous. The nature of Pranayama is to shine the light of awareness into the darkest corners of the body. This resonates deeply with my approach, as I believe Pranayama is not merely a breathing technique, but a sacred practice—a bridge between ancient spiritual wisdom and modern scientific understanding. Pranayama is the perfect opportunity to be curious about who you are! It is through this integration of knowledge and experience that the path to holistic well-being and self-realization truly unfolds. While the immediate impact of Pranayama on vocal performance may appear subtle at the individual level, its cumulative effects—when practiced consistently—can significantly enhance vocal strength, clarity, and resonance.*

Keywords: Pranayama; Scientific breathing; Voice enhancement; Vocal acoustics; Breath control; Acoustic analysis;

Holistic development, Pre-Post Evaluation, Praat Software (Version 6.4.01).

1. INTRODUCTION

Pranayama, the ancient science of conscious breathing, has been practiced since the dawn of civilization. It is not merely a wellness technique but a powerful tool for self-transformation, physical vitality, and mental well-being. This study explores how systematic Pranayama practice can significantly enhance vocal quality, reduce vocal strain, and improve acoustic parameters in singers and musicians [4].

2. PROBLEM STATEMENT

With continuous change in healthcare and increased vocal demands in professional settings:

- Musicians face vocal cord strain and breath control challenges.
- There is growing interest in non-invasive, holistic interventions.

This study focuses on addressing these challenges by enhancing:

- Pitch stability
- Vocal clarity
- Breath support
- Acoustic efficiency

3. RESEARCH METHODOLOGY

A mixed-methods approach was adopted:

Qualitative: A qualitative method is particularly suited when the goal is to understand "how" and "why" pranayama will impact vocal cords [3]. Case studies, open-ended interviews, participant observations, and feedback. The qualitative method is particularly suitable for exploring complex, contextual, and subjective experiences, making it ideal for research aimed at understanding the lived realities and perspectives of individuals within specific environments [2].

Quantitative: Voice recordings analyzed using software for acoustic parameters. While the core of this study adopts a qualitative case study approach—focusing on individual experiences, observations, and subjective feedback—the integration of voice data and speech analysis results introduces a quantitative dimension to the research [1].

4. PURPOSE OF THE STUDY

The study aims to:

- Provide a comprehensive framework for vocal health.
- Assess how Pranayama enhances well-being for singers and voice professionals.
- Combine scientific analysis with experiential feedback for robust evaluation.

4.1 Participants: 14 individuals (students and adults) engaged in structured Pranayama practice.

4.2 Aim and Objectives

- To offer a holistic solution for improving vocal performance and ensuring long-term vocal health
- **Assess voice, pitch, and clarity using Praat software.**
- Compare expert opinion with acoustic findings and evaluate the efficacy of specific Pranayama techniques.

5. RESEARCH QUESTIONS

This study addresses five key questions:

1. What challenges do musicians face while singing?
2. How can Scientific Pranayama help overcome these challenges?
3. Which five Pranayama techniques benefit the vocal cords?
4. What components are essential for complete vocal analysis?
5. How can these practices be structured for accessibility and sustainability?

6. SCIENTIFIC PRANAYAMA PACKAGE FOR VOCAL CORDS

Participants practiced the following daily regimen:

Pranayama	Duration (1 month daily)
Bhastrika	5 minutes
Ujjayi	10 minutes
Bhramari	10 repetitions
Anuloma Viloma	15 minutes
Pranava	5 minutes

7. ACOUSTIC VOICE PARAMETERS (MEAN ± SD)

These improvements suggest enhanced breath support, better glottal closure, and reduced laryngeal tension following Pranayama.

Table -1: Acoustic Voice Parameters (Mean ± SD)

Parameter	Pre-Pranayama (Mean ± SD)	Post-Pranayama (Mean ± SD)	Change Direction
Min Pitch (Hz)	90.89 ± 48.43	100.22 ± 46.45	↑ (Increase)
Max Pitch (Hz)	443.48 ± 120.73	400.82 ± 60.35	↓ (Decrease)
Min Intensity (dB)	37.19 ± 12.98	30.31 ± 19.98	↓
Max Intensity (dB)	108.13 ± 94.39	109.05 ± 94.15	≈ (No major change)
Jitter (%)	1.02 ± 0.51	0.82 ± 0.33	↓

Shimmer (%)	9.46 ± 4.69	6.57 ± 3.17	↓
NHR	0.10 ± 0.07	0.06 ± 0.06	↓

8. INTERPRETATION OF RESULTS

Key Findings:

- **Pitch Stability:** Minimum pitch increased, and maximum pitch decreased — indicating better vocal control and reduced strain.
- **Intensity Variation:** Slight reduction in minimum intensity suggests improved breath support, while maximum intensity remained stable.
- **Voice Perturbation:** Significant reduction in **Jitter** and **Shimmer**, indicating improved vocal fold vibration.
- **Noise-to-Harmonic Ratio (NHR):** Decreased significantly — indicating clearer and purer voice quality.

9. PARTICIPANTS PERFORMANCE IMPROVEMENT

- Participant **P9** showed the most improvement with a **50% gain**.
- Both younger and older participants benefited, proving the universal applicability of Pranayama.

10. CONCLUSIONS

Scientific Pranayama can be considered a **supportive and complementary therapy** alongside medical treatment for vocal disorders. Overall, participants demonstrated:

- Improved vocal clarity and better pitch control
- Enhanced oxygen intake and gas exchange
- Reduced laryngeal tension and enhanced vocal hygiene

11. FUTURE DIRECTIONS

- Take a large sample size and perform long-term studies over time
- Apply advanced statistical analysis and explore effects on dysphonia patients, children, and instrumentalists

Integrating Scientific Pranayama with music education and therapy opens new pathways for **vocal excellence and holistic well-being**.

ACKNOWLEDGMENT

I sincerely thank my Research Guide, **Dr. Devaki Madhav**, for her invaluable guidance and support. I am also deeply grateful to my husband, **Dr. Gururaj Achar**, for his constant encouragement and unwavering belief in me.

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