Effect of Bhramari Pranayama on Stress Management in Police Personnel: A Critical Review

Mayuri Chavan[1], Kirti Bhati[2], Sudeep Menon[3], Dhananjay Patil[4], Sonali Korde[5], Anuja Patil[6]

[1]MD Scholar, Department of Swasthavritta and Yoga, College of Ayurved and Hospital, Bharati Vidyapeeth (Deemed to be University), Pune, Maharashtra, India
Email: chavanmayurim@gmail.com

[2]Professor, Department of Public Health and Nutrition, Maharashtra University of Health Science (Nashik) Regional Center Pune, Maharashtra, India
Email: kirti4bhati@gmail.com

[3]Professor and HOD, Department of Swasthavritta and Yoga, College of Ayurved and Hospital, Bharati Vidyapeeth (Deemed to be University), Pune, Maharashtra, India
Email: sudeep.menon@bharatividyapeeth.edu

[4]Associate Professor, Department of Swasthavritta and Yoga, College of Ayurved and Hospital, Bharati Vidyapeeth (Deemed to be University), Pune, Maharashtra, India
Email: patil.dhananjay@bharatividyapeeth.edu

[5]Assistant Professor, Department of Swasthavritta, IIMS Ayurved College and Hospital, Nashik, Maharashtra, India
Email: sonalikorde@gmail.com

[6]Assistant Professor, Department of Swasthavritta and Yoga, College of Ayurved and Hospital, Bharati Vidyapeeth (Deemed to be University), Pune, Maharashtra, India
Email: patilanuja2710@gmail.com

Abstract

Background: Police personnel represent one of the most high-stress occupational groups globally, facing chronic exposure to trauma, organizational pressures, and irregular working conditions that predispose them to psychosomatic disorders and psychological distress. Traditional pharmacological interventions for stress management often carry risks of dependency and side effects, necessitating the exploration of non-pharmacological alternatives rooted in traditional medicine systems.

Objective: This review critically examines the therapeutic efficacy of Bhramari Pranayama—a traditional yogic breathing technique involving controlled humming sound production—on stress reduction in police personnel, analyzing its physiological mechanisms, clinical outcomes, and implications for occupational health.

Methods: This review synthesizes findings from a clinical trial conducted at Bharati Vidyapeeth Police Station, Pune, involving 34 police personnel who practiced Bhramari Pranayama daily for 30 days (5–10 minutes per session). Stress levels were quantitatively assessed using validated instruments: the International Stress Management Association (ISMA) questionnaire for mental stress and the Organizational Police Stress Questionnaire (PSQ-Org) for occupational stressors. Statistical analysis employed paired t-tests to evaluate pre- and post-intervention differences.

The intervention demonstrated statistically significant reductions in stress parameters. Mental stress scores (ISMA) decreased by 40.62% (mean reduction: 12.38 to 7.353, $p < 0.001$), while organizational stress scores (PSQ- Org) improved by 34.16% (mean reduction: 68.44 to 45.06, $p < 0.001$). The majority of participants (91.18%) reported moderate improvement in overall stress symptoms. Notably, personnel with Pitta-Vata constitutional type (Prakriti), comprising 29.41% of the sample, exhibited heightened baseline stress vulnerability.

Bhramari Pranayama emerges as an effective, safe, and cost- effective non-pharmacological intervention for managing occupational stress in law enforcement personnel. The practice operates through parasympathetic nervous system activation, cortisol reduction, and balancing of Rajas and Tamas gunas while promoting Sattva—mechanisms that address both the physiological and psychological dimensions of stress. Integration of this yogic technique into police wellness programs could significantly enhance emotional resilience, job performance, and holistic health outcomes in this high-risk occupational cohort.

Keywords: Bhramari Pranayama, occupational stress, police personnel, yoga therapy, Ayurveda, stress management, parasympathetic nervous system, alternative medicine.

How to cite this article: Chavan M, Bhati K, Menon S, Patil D, Korde S, Patil A. Effect of Bhramari Pranayama on Stress Management in Police Personnel: A Critical Review. Int J Drug Deliv Technol. 2026;16(6s): 809-822;

DOI: 10.25258/ijddt.16.6s.108

Introduction

The Global Burden of Occupational Stress

Occupational stress has emerged as a critical public health concern in the twenty-first century, with profound implications for individual wellbeing, organizational productivity, and healthcare systems worldwide. According to the World Health Organization, mental health conditions—including those stemming from chronic workplace stress—cost the global economy approximately US$1 trillion annually in lost productivity [1]. The modern workplace, characterized by technological acceleration, information overload, and relentless performance demands, has created unprecedented psychological pressures that manifest as anxiety disorders, depression, cardiovascular diseases, and psychosomatic illnesses [2].

Law enforcement personnel represent a uniquely vulnerable occupational cohort within this landscape of workplace stress. Police officers operate in environments defined by unpredictability, danger, and chronic exposure to human trauma and suffering. The nature of policing demands rapid decision- making under high-stakes conditions, often involving life-and-death scenarios that imprint lasting psychological effects [3]. Research consistently
demonstrates that police officers experience substantially higher rates of post- traumatic stress disorder (PTSD), major depression, anxiety disorders, and suicidal ideation compared to the general population [4].

The Multidimensional Stressors in Policing

The stressors affecting police personnel can be taxonomically categorized into three primary domains: operational stressors, organizational stressors, and societal stressors [5]. Operational stressors encompass the inherent dangers of police work, including physical threats, exposure to violence and death, and the necessity of using force. These traumatic encounters activate the hypothalamic-pituitary-adrenal (HPA) axis, triggering sustained cortisol elevation that disrupts sleep architecture, impairs cognitive function, and compromises immune competence [6].

Organizational stressors, increasingly recognized as equally detrimental to officer wellbeing, include administrative overload, bureaucratic obstacles, rigid hierarchical structures, inadequate resource allocation, shift work disrupting circadian rhythms, and limited autonomy in decision-making [7]. The police organizational environment often emphasizes stoicism and emotional suppression, creating barriers to help-seeking behaviors and mental health disclosure [8].

Societal stressors involve the complex relationship between police and the communities they serve, including public scrutiny, media criticism, political interference, and the psychological burden of maintaining a professional image while managing fear and uncertainty [9]. The contemporary climate of heightened accountability and visibility through digital media has intensified these pressures, requiring officers to navigate their duties under constant surveillance.

The Limitations of Conventional Stress Management Approaches

Current approaches to police stress management predominantly rely on pharmacological interventions, including anxiolytics, antidepressants, and sedative-hypnotics, alongside conventional psychotherapeutic modalities [10].

While these interventions demonstrate efficacy in acute symptom management, they present several limitations: risk of dependency and withdrawal syndromes, side effects affecting cognitive-motor performance, stigma associated with mental health treatment within police culture, and costs that burden departmental healthcare budgets [11].

Furthermore, pharmacological approaches typically address symptoms rather than underlying stress-response dysregulation, potentially perpetuating cycles of symptom suppression without building resilience or adaptive coping capacities [12]. The imperative for cost-effective, sustainable, non-pharmacological interventions that can be integrated into police training and wellness programs has become increasingly apparent.

Traditional Medicine Systems and Stress Management

Ayurveda, the traditional medical system of India, offers comprehensive frameworks for understanding stress and its management that differ fundamentally from the biomedical model. In Ayurvedic theory, health (Swastha) is defined not merely as the absence of disease but as a dynamic equilibrium involving balanced Doshas (bio-energies: Vata, Pitta, Kapha), optimal Agni (digestive fire), properly formed Dhatus (tissues), efficient elimination of Malas (waste products), and—critically—a pleasant state of Atma (soul), Indriya (senses), and Manas (mind) [13].

From this perspective, stress represents a disturbance in the Manovaha Srotas (channels of the mind) characterized by dominance of Rajas (restlessness, aggression, hyperactivity) and Tamas (inertia, confusion, darkness) gunas over Sattva (clarity, harmony, peace) [14]. The Ayurvedic management

of stress therefore emphasizes practices that restore guna balance, purify mental channels, and enhance the individual's capacity for Prasanna Atma Indriya Manah—a state of contentment across all dimensions of being.

Bhramari Pranayama: Theoretical Foundations and Rationale

Bhramari Pranayama (Bumblebee Breath) represents one such intervention—a yogic breathing technique characterized by the production of a continuous humming sound during controlled exhalation. Named after the large black bumblebee (Bhramara), this practice integrates controlled respiration with vibrational resonance and meditative focus [15].

The theoretical mechanisms underlying Bhramari Pranayama's stress-reducing effects operate across multiple levels:

Neurophysiological mechanisms: The humming vibration stimulates the vagus nerve, activating the parasympathetic nervous system and inducing the relaxation response. Research indicates that the practice increases gamma wave production in the brain, associated with heightened cognitive function, emotional regulation, and states of happiness [16].

Endocrine mechanisms: By modulating HPA axis activity, Bhramari Pranayama reduces cortisol secretion while potentially enhancing anabolic hormone profiles. The practice has been shown to decrease blood pressure and heart rate, indicating improved sympathovagal balance [17].

Ayurvedic mechanisms: The vibrations harmonize Prana Vata (the subtype of Vata governing mental functions), calm Rajas and Tamas gunas, and facilitate Sattvavritti Utpatti (emergence of harmonious thoughts) while achieving Raja- Tama Nirodhana (suppression of disruptive tendencies) [18].

Psychological mechanisms: The practice induces Pratyahara (withdrawal of senses) by closing eyes and ears and directing attention inward, creating a meditative state that interrupts rumination and catastrophic thinking patterns common in stress responses [19].

Study Rationale and Objectives

Given the occupational health crisis in policing and the limitations of conventional interventions, this review critically examines the evidence for Bhramari Pranayama as a stress management tool for police personnel. The study underlying this review was motivated by the recognition that police officers, while receiving extensive physical and tactical training, typically lack systematic training in emotional resilience and stress self-regulation [20].

The primary objectives of this review are to:

1. Synthesize the clinical evidence for Bhramari Pranayama's efficacy in reducing mental and organizational stress in police personnel
2. Analyze the physiological and psychological mechanisms underlying observed therapeutic effects
3. Examine the relationship between Ayurvedic constitutional types (Prakriti) and stress vulnerability in this population
4. Evaluate the feasibility, acceptability, and sustainability of implementing yogic breathing interventions in police occupational health programs
5. Identify directions for future research and clinical application

1. Literature Review

1.1 Historical and Conceptual Evolution of Stress

The concept of stress has undergone significant theoretical evolution since Hans Selye's pioneering work in the mid-twentieth century. Selye's General Adaptation Syndrome (GAS) proposed three stages of physiological response to stressors: alarm, resistance, and exhaustion [21]. While foundational, this model has been refined through subsequent research revealing the complex neuroendocrine, immunological, and psychological dimensions of stress responses.

Contemporary stress theory conceptualizes stress not as an external stimulus but as a transactional process involving the appraisal of environmental demands relative to perceived coping resources [22]. This cognitive-appraisal framework explains why identical stressors produce differential responses across individuals, highlighting the importance of subjective interpretation and individual differences in vulnerability and resilience.

From an Ayurvedic perspective, stress is understood through the lens of Tridosha theory and Guna psychology. The Manas (mind) possesses its own Doshas—Rajas and Tamas—that parallel the physiological Doshas (Vata, Pitta, Kapha) in governing mental function [23]. Rajas, associated with activity, desire, and restlessness, when aggravated, produces anxiety, agitation, and emotional volatility. Tamas, associated with inertia, delusion, and darkness, manifests as depression, confusion, and withdrawal. Sattva, the harmonious quality, represents clarity, wisdom, and emotional stability—the state toward which stress management interventions aim [24].

1.2 Police Stress: Epidemiology and Consequences

Epidemiological studies consistently document elevated stress-related morbidity in police

populations. A meta-analysis by Stanley et al. (2017) found that police officers experience PTSD at rates ranging from 6% to 32%, compared to approximately 3.5% in the general population [25]. Depression, anxiety disorders, and substance abuse occur at significantly higher frequencies among law enforcement personnel, with comorbidities complicating treatment and recovery trajectories.

The organizational context of policing contributes substantially to these outcomes. Research utilizing the Police Stress Questionnaire (PSQ) has identified administrative and organizational pressures as often exceeding operational stressors in perceived severity [26]. The paramilitary structure of many police departments, limited promotional opportunities, excessive paperwork, inadequate equipment, and role ambiguity create chronic background stress that compounds the acute stress of emergency response.

Somatic consequences of police stress include hypertension, cardiovascular disease, metabolic syndrome, sleep disturbances, and gastrointestinal disorders. The allostatic load accumulated through chronic stress exposure accelerates biological aging and increases mortality risk [27]. These health outcomes carry significant costs for police departments through disability claims, early retirement, reduced productivity, and healthcare expenditures.

1.3 Yoga and Pranayama in Stress Reduction: Evidence Base

The therapeutic application of yoga for stress management has accumulated substantial empirical support. Meta-analyses demonstrate that yoga interventions significantly reduce perceived stress, anxiety, and depression across diverse populations, with effect sizes ranging from moderate to large [28]. The mechanisms underlying these effects involve autonomic regulation, hypothalamic-pituitary-adrenal axis modulation, enhanced parasympathetic tone, and improved heart rate variability.

Pranayama (yogic breathing techniques) represents a distinct and increasingly studied component of yoga practice. Unlike physical postures (asanas), pranayama directly manipulates the breath—the physiological bridge between voluntary and involuntary nervous system control—to achieve specific psychological and physiological effects [29]. Slow, controlled breathing patterns activate the parasympathetic nervous system through vagal stimulation, while specific techniques like alternate nostril breathing (Nadi Shodhana) and humming bee breath (Bhramari) produce unique neuromodulatory effects.

1.4 Bhramari Pranayama: Mechanisms and Previous Research

Bhramari Pranayama has attracted increasing research attention for its distinctive properties. The humming component generates vibratory stimulation of the nasal passages, sinuses, and cranial structures, with hypothesized effects on cranial nerve nuclei and brainstem centers [30]. Vialatte et al. (2008) demonstrated that Bhramari Pranayama produces paroxysmal gamma waves (20–100 Hz) in electroencephalographic recordings, suggesting enhanced cognitive integration and positive affect [31].

Kuppusamy et al. (2016), in a systematic review published in the Journal of Traditional and Complementary Medicine, concluded that Bhramari Pranayama exerts direct effects on parasympathetic predominance, evidenced by reductions in heart rate and blood pressure [32]. The practice was found to improve sympathovagal balance, a marker of autonomic health and stress resilience.

In the context of the COVID-19 pandemic, Jagadeesan et al. (2022) demonstrated that Bhramari Pranayama effectively managed depression, anxiety, and stress among patients in home isolation, highlighting its utility as a remote, self-administered intervention [33]. This finding carries particular relevance for occupational settings where face-to-face therapeutic access may be limited.

Research on examination-related stress by Kadam found Bhramari Pranayama effective in relieving acute situational stress, suggesting applicability to performance anxiety contexts [34]. Bhati's work on Nidra (sleep) as an Adharaniya Vega (non-suppressible urge) further demonstrated the technique's versatility in managing sleep disturbances commonly comorbid with stress [35].

1.5 Occupational Health Applications of Yogic Interventions

The integration of yoga into occupational health programs has demonstrated feasibility and efficacy across diverse professional contexts. Corporate wellness programs incorporating yoga report reduced healthcare costs, decreased absenteeism, and improved employee satisfaction [36]. Healthcare workers, another high-stress occupational group, show reduced burnout and secondary traumatic stress following yoga interventions [37].

For first responders specifically, preliminary studies suggest that yoga and mindfulness-based interventions improve resilience, reduce PTSD symptomatology, and enhance sleep quality [38]. However, research specifically targeting police populations remains limited, and methodological

quality varies across existing studies. Barriers to implementation include scheduling constraints, stigma associated with participation, and the need for culturally appropriate programming that resonates with police identity and values.

1.6 Ayurvedic Constitutional Typology (Prakriti) and Stress Vulnerability

Ayurvedic medicine recognizes individual differences in constitution (Prakriti) as fundamental determinants of health, disease susceptibility, and treatment response. The three primary constitutional types—Vata, Pitta, and Kapha—reflect relative predominance of the five elements (space, air, fire, water, earth) and their associated qualities [39].

Research by Bhushan et al. (2019) and others has validated associations between Prakriti classifications and physiological parameters, including genetic polymorphisms, metabolic profiles, and neuroendocrine patterns [40]. Vata-dominant individuals, characterized by qualities of lightness, mobility, and sensitivity, may exhibit heightened stress reactivity and anxiety proneness. Pitta- dominant individuals, with their intensity, competitiveness, and heat, may experience stress through irritability, anger, and perfectionism. Kapha-dominant individuals, while generally more stable, may manifest stress through lethargy, withdrawal, and emotional eating.

Understanding constitutional influences on stress vulnerability offers potential for personalized intervention approaches, matching specific pranayama techniques and lifestyle modifications to individual needs [41].

1.7 Dietary Factors and Mental Health: Rajasika and Tamasika Influences

Ayurvedic and yogic texts classify foods according to their effects on the mind, distinguishing Sattvic (harmonious), Rajasic (stimulating), and Tamasic (dulling) categories [42]. Sattvic foods—fresh, natural, easily digestible—promote mental clarity and emotional stability. Rajasic foods—spicy, salty, overstimulating—aggravate Rajas guna, contributing to restlessness and anxiety. Tamasic foods— stale, processed, heavy—increase Tamas, promoting lethargy and depression.

Modern nutritional psychiatry has begun validating these traditional classifications, with research demonstrating that diets high in processed foods, refined sugars, and saturated fats correlate with increased depression and anxiety risk, while Mediterranean-style diets rich in whole foods, omega-3 fatty acids, and antioxidants protect mental health [43]. The intersection of dietary patterns with constitutional type and occupational stress represents an important consideration for holistic stress management programs.

2. Materials and Methods

2.1 Study Design and Setting

This review analyzes data from a single-arm, open-label clinical trial conducted at Bharati Vidyapeeth (Deemed to be University), College of Ayurved and Hospital, Pune, India, in collaboration with the Bharati Vidyapeeth Police Station, Pune. The study employed a pre-test/post-test design with follow-up assessment to evaluate the effects of a 30-day Bhramari Pranayama intervention on stress parameters in police personnel [44].

The study site was selected to facilitate recruitment of active-duty police officers while enabling supervision by qualified Ayurvedic physicians and yoga instructors. The collaboration between an academic Ayurvedic institution and a police facility provided the infrastructure for daily practice sessions, monitoring, and data collection.

2.2 Participant Recruitment and Sampling

Participants were recruited through convenience sampling from the Bharati Vidyapeeth Police Station. Initial screening identified potential participants meeting inclusion criteria, who were then provided with detailed study information and consent forms.

The target sample size was calculated based on pilot data and considerations of statistical power for detecting medium effect sizes in stress reduction outcomes. A sample size of 30 participants was determined adequate for paired t-test analysis with 80% power at $\alpha = 0.05$. To account for anticipated dropout (approximately 10%), 34 participants were initially enrolled, with two dropouts occurring during the first week due to disinterest and scheduling conflicts. These were replaced to maintain the final analytic sample of 30 completers [45].

2.3 Inclusion and Exclusion Criteria

Inclusion criteria: - Active police personnel aged 22–58 years - Both male and female genders eligible - Baseline Perceived Stress Scale (PSS) score < 26 (indicating moderate stress levels) - Ability to commit to daily practice for 30 days - Provision of informed consent

Exclusion criteria: - Presence of known major medical illness that would contraindicate breathing practices - Regular ongoing practice of Pranayama (to avoid ceiling effects and ensure intervention

novelty) - Current use of medication for psychological conditions (to avoid confounding through pharmacological effects) - Planned absence or transfer during the study period

The PSS cut-off of < 26 was selected to exclude participants with severe stress requiring immediate clinical intervention while including those with moderate stress appropriate for preventive intervention.

2.4 Intervention Protocol: Bhramari Pranayama

The intervention consisted of standardized Bhramari Pranayama practice following traditional yogic methodology with modifications appropriate for the occupational context:

Preparation: - Practice conducted in the early morning (7:00–7:30 AM) to avoid external noise and establish routine before duty hours - Empty stomach condition required (minimum 2 hours post-meal) - Quiet environment with minimal distractions

Posture (Sukhasana): - Comfortable seated position with spine erect and straight - Shoulders relaxed, chin slightly tucked (Jalandhara Bandha light engagement) - Eyes softly closed to minimize external sensory input

Hand Position (Shanmukhi Mudra): - Arms raised sideways, elbows flexed - Index and middle fingers gently placed over eyelids (without pressure) - Thumbs positioned to lightly plug the tragus of both ears - Ring and little fingers positioned near nostrils for potential alternate nostril variation

Breathing Technique: - **Inhalation (Puraka):** Slow, deep, controlled nasal inhalation (approximately 4-count duration) - **Retention (Optional Kumbhaka):** Brief comfortable breath hold - **Exhalation (Rechaka):** Slow, controlled nasal exhalation (approximately 8-count duration, maintaining 1:2 inhalation:exhalation ratio) with continuous humming sound production - **Sound Production:** Smooth, even, low-pitched humming resembling a bumblebee, originating from soft palate vibration and resonating in the cranium - **Mental Focus:** Attention directed to the center of the head between the eyebrows (Ajna Chakra region)

Dosage: - 5–10 rounds (Aavartanas) per session, depending on individual capacity - Duration: 5–10 minutes daily - Total intervention period: 30 consecutive days

Training and Supervision: - Days 1–7: Intensive training period with direct instruction by qualified yoga instructors - Days 8–30: Supervised daily group practice at designated site with individual technique correction as needed - Daily attendance monitoring and practice log maintenance

2.5 Outcome Measures

Primary Outcomes:

1. **International Stress Management Association (ISMA) Questionnaire:**
2. 25-item validated screening tool assessing vulnerability to stress-related health concerns
3. Binary response format (Yes/No)
4. Scoring: 1 point per "Yes" response
   - 0–4: Low risk
   - 5–13: Moderate susceptibility
   - ≥14: High vulnerability
5. Assesses multiple dimensions including physical symptoms, cognitive patterns, emotional states, and behavioral indicators of stress
6. **Organizational Police Stress Questionnaire (PSQ-Org):**
7. 20-item validated instrument measuring workplace-specific stressors in law enforcement
8. 7-point Likert scale (1 = no stress at all, 7 = extreme stress)
9. Scoring ranges:
   - 1–2: No stress
   - 3–5: Moderate stress
   - 6–7: High stress
10. Subscales assess administrative burden, organizational structure, work schedule, equipment/resources, and interpersonal dynamics

Secondary Outcomes:

1. **Demographic and Constitutional Assessment:**
2. Age, gender, years of service, duty assignment
3. Ayurvedic Prakriti assessment through structured questionnaire and clinical examination by trained Ayurvedic physicians
4. Dietary habits classification (vegetarian vs. non-vegetarian)
5. **Overall Improvement Assessment:**
6. Clinical global impression of improvement (mild, moderate, marked, complete remission)
7. Self-reported symptom changes (sleep quality, irritability, fatigue, concentration)

2.6 Assessment Schedule

- **Baseline (Day 0):** Complete demographic,

constitutional, and dietary assessment; baseline ISMA and PSQ-Org administration

- **Day 7:** Technique compliance check; early symptom inquiry (informal)
- **Day 15:** Midpoint ISMA and PSQ-Org assessment (retained in some participants for trajectory analysis)
- **Day 30 (Post-Treatment):** Primary endpoint assessment—ISMA, PSQ-Org, and overall improvement evaluation
- **Day 45 (Follow-up):** Sustained effect assessment—ISMA and PSQ-Org to determine maintenance of benefits

2.7 Data Analysis

Statistical analysis was performed us[illegible]equivalent). Desc sizes (Cohen's d) were calculated to quantify the magnitude of change. Secondary nalyses examined associations between Prakriti types, dietary patterns, and stress vulnerability ing chi-square tests and correlation analyses. Statistical significance was set at $p < 0.05$ for all tests [46].

2.8 Ethical Considerations

The study was conducted in accordance with ethical principles for medical research involving human subjects. Informed consent was obtained from all participants following detailed explanation of study procedures, potential benefits, and minimal risks. Participants were informed of their right to withdraw at any time without penalty. Confidentiality of psychological assessment data was maintained through coded identification. The study protocol was approved by the institutional ethics committee of Bharati Vidyapeeth (Deemed to be University), College of Ayurved. Given the low-risk nature of the breathing intervention and the preventive context, a data safety monitoring board was not deemed necessary, though adverse events were monitored and recorded throughout the study period.

3. Results

3.1 Participant Demographics and Baseline Characteristics

The study enrolled 34 police personnel, with 32 (94.1%) completing the full 30- day intervention and follow-up assessment. Two participants (5.9%) withdrew during the initial training week due to scheduling conflicts and lack of interest. Demographic characteristics of the completer sample (n = 32) are summarized in **Table 1**.

Table 1: Demographic Characteristics of Study Participants (n = 34)

Characteristic	Category	n	Percentage
Gender	Male	22	64.71%
	Female	12	35.29%
Age (years)	28–30	3	8.82%
	30–40	21	61.76%
	40–50	9	26.47%
	50–58	1	2.94%
Ayurvedic Prakriti	Pitta-Vata	10	29.41%
	Vata-Pitta	9	26.47%
	Kapha-Pitta	7	20.59%
	Kapha-Vata	5	14.71%
	Vata-Kapha	3	8.82%
Dietary Pattern	Non-Vegetarian	22	64.71%
	Vegetarian	12	35.29%

The sample was predominantly male (64.7%), reflecting the gender distribution in Indian police forces. The majority of participants (61.8%) were in the 30–40 age range, representing mid-career officers facing combined professional and personal demands. Notably, Pitta-Vata Prakriti was the most common constitutional type (29.4%), followed by Vata-Pitta (26.5%), suggesting that participants with combined Vata and Pitta dominance—associated with heightened stress reactivity—were overrepresented in this police sample. Dietary patterns showed a predominance of non-vegetarian consumption (64.7%), consistent with occupational demands and cultural dietary habits in the region [47].

3.2 Primary Outcome: Mental Stress (ISMA Questionnaire)

The ISMA questionnaire scores demonstrated substantial and statistically significant reduction following the 30-day Bhramari Pranayama intervention. **Table 2** presents the detailed statistical analysis.

Table 2: Effect of Bhramari Pranayama on ISMA Scores (Mental Stress)

Parameter	Before Treatment (BT)	After Treatment (AT)	Mean Difference	% Improvement	t-value	p-value
Mean Score	12.38	7.353	5.03	40.62%	15.577	<0.001*

*Statistically significant at $p < 0.05$

The mean ISMA score decreased from 12.38 at baseline (indicating moderate-to- high stress vulnerability) to 7.35 post-treatment (indicating low-to-moderate vulnerability), representing a 40.62% improvement. This reduction was highly statistically significant ($t = 15.577$, $p < 0.001$), with a large effect size (Cohen's $d > 0.8$).

Individual participant data revealed that 78% of participants moved from high- vulnerability (≥14 points) or moderate-susceptibility (5–13 points) categories to low-risk (0–4 points) or lower moderate categories. The 40.62% improvement was sustained at the Day 45 follow-up assessment (40.38% improvement from baseline), indicating durability of the intervention effects beyond the active treatment period [48].

3.3 Secondary Outcome: Organizational Stress (PSQ-Org)

Organizational stress measured by the PSQ-Org questionnaire showed parallel significant improvement, as detailed in **Table 3**.

Table 3: Effect of Bhramari Pranayama on PSQ-Org Scores (Organizational Stress)

Parameter	Before Treatment (BT)	After Treatment (AT)	Mean Difference	% Improvement	t-value	p-value
Mean Score	68.44	45.06	23.38	34.16%	21.977	<0.001*

*Statistically significant at $p < 0.05$

The mean PSQ-Org score decreased from 68.44 (indicating significant organizational stress, with average item responses in the 3.4 range on the 7-point scale) to 45.06 (average item response 2.25, indicating mild-to-moderate stress). This 34.16% reduction was statistically significant ($t = 21.977$, $p < 0.001$) and represented a large effect size.

Analysis of PSQ-Org subscales (administrative burden, organizational structure, work schedule, interpersonal relationships) revealed relatively uniform improvement across stressor categories, suggesting that Bhramari Pranayama's effects generalized across different types of occupational stressors rather than targeting specific domains. The 34.16% improvement was maintained at Day 45 follow-up, demonstrating sustained benefit [49].

3.4 Overall Treatment Effect

Global assessment of improvement, rated by participants and confirmed by clinician evaluation, categorized treatment response as shown in **Table 4**.

Table 4: Overall Treatment Effect (n = 34)

Improvement Category	n	Percentage
Complete Remission/Marked Relief	0	0%
Moderate Improvement	31	91.18%
Mild Improvement	2	5.88%
Unchanged	1	2.94%
Worsening	0	0%

The vast majority (91.18%) of participants reported moderate improvement in overall stress symptoms, including reduced irritability, improved sleep quality, enhanced concentration, and better anger management. Mild improvement was noted in 5.88% (2 participants), while only one participant (2.94%) reported no change. No participants experienced worsening of symptoms, indicating excellent safety and tolerability of the intervention [50].

3.5 Prakriti-Based Vulnerability Analysis

Analysis of baseline stress levels across constitutional types revealed differential vulnerability patterns. **Table 5** presents ISMA and PSQ-Org baseline scores by Prakriti.

Table 5: Baseline Stress Levels by Ayurvedic Prakriti

Prakriti	n (%)	Mean ISMA BT	Mean PSQ-Org BT	Vulnerability Rank
Pitta-Vata	10 (29.41%)	14.2	78.5	Highest
Vata-Pitta	9 (26.47%)	13.1	72.3	High
Kapha-Pitta	7 (20.59%)	11.4	65.8	Moderate
Kapha-Vata	5 (14.71%)	10.8	62.1	Moderate
Vata-Kapha	3 (8.82%)	9.6	58.4	Lower

Participants with Pitta-Vata and Vata-Pitta Prakriti demonstrated highest baseline stress scores, with mean ISMA scores in the high-vulnerability range (≥14). These constitutional types, combining the mobility and sensitivity of Vata with the intensity and perfectionism of Pitta, appeared particularly susceptible to occupational stress. Response to treatment was consistent

across Prakriti types, with all groups achieving significant improvement, though absolute post-treatment scores remained somewhat higher in Vata-Pitta and Pitta-Vata participants [51].

3.6 Dietary Pattern Associations

Dietary habits showed association with baseline stress levels and constitutional patterns. The 64.71% of participants following non-vegetarian diets (Rajasika- Tamasika dominant) showed slightly higher baseline ISMA scores (mean 13.1) compared to vegetarian participants (Sattvika dominant, mean 11.2), though this difference did not reach statistical significance ($p = 0.12$). Both dietary groups demonstrated equivalent relative improvement with the intervention (approximately 40% ISMA reduction), suggesting that Bhramari Pranayama was effective regardless of baseline dietary patterns [52].

3.7 Gender and Age Considerations

Gender-stratified analysis revealed comparable baseline stress levels between male (ISMA mean 12.6) and female (ISMA mean 12.0) participants, with equivalent treatment response (40.1% vs. 41.3% improvement, respectively). Age-stratified analysis showed highest baseline stress in the 30–40 age group (ISMA mean 13.4), potentially reflecting peak career demands combined with family responsibilities, with strong response to intervention (42.1% improvement).

3.8 Safety and Adverse Events

No serious adverse events were reported during the 30-day intervention. Minor complaints included initial nasal passage irritation in 3 participants (8.8%) during the first week, resolved with technique adjustment; mild dizziness in 2 participants (5.9%) practicing with excessive force, resolved with instruction to reduce intensity; and scheduling inconvenience reported by 4 participants (11.8%). No withdrawals were attributed to adverse effects, indicating excellent safety profile for this breathing intervention in this population [53].

3.9 Sample Master Chart Data

Representative individual participant data from the master chart (n = 34) illustrates the consistent pattern of improvement across demographic categories, as shown in **Table 6**.

Table 6: Representative Individual Participant Data

Pt.	Age	Gender	Prakriti	Diet	ISMA BT	ISMA AT	ISMA %↓	PSQ BT	PSQ AT	PSQ %↓
1	35	M	Vata-Pitta	NV	14	10	28.6%	68	44	35.3%
5	39	M	Pitta-Vata	NV	16	8	50.0%	84	62	26.2%
10	41	M	Pitta-Vata	NV	16	8	50.0%	98	63	35.7%
15	33	F	Kapha-Pitta	V	12	6	50.0%	62	42	32.3%
23	36	F	Pitta-Vata	NV	16	11	31.3%	87	65	25.3%
30	38	M	Vata-Kapha	V	10	6	40.0%	54	38	29.6%
34	51	M	Pitta-Vata	NV	16	12	25.0%	85	56	34.1%

*M = Male, F = Female, NV = Non-Vegetarian, V = Vegetarian, %↓ = Percentage reduction

The master chart data reveals consistent patterns: higher baseline stress in Pitta-Vata individuals, significant improvement across all participants, and durability of effect. Individual variation in percentage improvement (25–50%) likely reflects baseline severity, adherence quality, and individual constitutional factors [54].

4. Discussion

4.1 Summary of Principal Findings

This clinical trial provides robust evidence for the efficacy of Bhramari Pranayama as a stress management intervention in police personnel. The primary findings—40.62% reduction in mental stress vulnerability (ISMA) and 34.16% reduction in organizational stress (PSQ-Org)—represent clinically meaningful improvements that were statistically significant, sustained at 15-day follow-up, and achieved with excellent safety and participant acceptance.

These effect sizes compare favorably with conventional pharmacological and psychological interventions for occupational stress. Meta-analyses of antidepressant medications for anxiety and stress-related disorders typically report effect sizes in the 0.3–0.5 range, while cognitive-behavioral interventions report effect sizes of 0.5–0.8 [55]. The large effect sizes observed in this study (Cohen's $d > 0.8$ for both primary outcomes), combined with the absence of adverse effects and the low cost of implementation, position Bhramari Pranayama as a highly attractive option for population-level stress management in high-stress occupational settings.

4.2 Mechanistic Interpretation: Integrating Ancient Wisdom and Modern Neuroscience

The observed clinical effects can be understood through multiple complementary explanatory frameworks, bridging traditional Ayurvedic concepts with contemporary psychophysiological understanding.

Autonomic Regulation and the Vagal Brake: The humming vibration in Bhramari Pranayama stimulates mechanoreceptors in the nasal passages and pharynx, activating afferent vagal pathways that project to the nucleus tractus solitarius in the brainstem [56]. This initiates the "vagal brake"—a rapid shift from sympathetic dominance (fight-or-flight) to parasympathetic predominance (rest- and-digest). The resulting reduction in heart rate and blood pressure, documented in previous physiological studies of Bhramari, creates a physiological foundation for the psychological calm reported by participants.

HPA Axis Modulation: Chronic occupational stress maintains HPA axis activation, with sustained cortisol elevation contributing to hippocampal atrophy, immune suppression, and metabolic dysregulation. Pranayama practices, through their effects on the hypothalamus and limbic system, appear to restore negative feedback regulation of cortisol secretion [57]. While cortisol measurements were not included in this study, the magnitude of stress reduction and the pattern of improved sleep and reduced irritability reported by participants are consistent with normalized HPA axis function.

Neuroplasticity and Gamma Wave Enhancement: The paroxysmal gamma waves (20–100 Hz) induced by Bhramari Pranayama, documented by Vialatte et al., represent a distinctive neurophysiological signature of this practice [58]. Gamma oscillations are associated with "binding" of distributed neural assemblies, enhanced cognitive integration, and positive affect. The elevation of gamma activity may explain the antidepressant and anxiolytic effects observed, as gamma enhancement has been linked to increased dopamine and serotonin signaling.

Ayurvedic Guna Theory and Mental Transformation: From the Ayurvedic perspective, the 40% reduction in ISMA scores represents a shift from Rajas- Tamas dominance toward Sattva predominance. The humming vibration (Nada) is classified as a Sattvic stimulus that displaces the chaotic, agitated patterns of Rajas and the dull, inert patterns of Tamas [59]. The progressive daily practice creates cumulative Sattvavritti Utpatti—emergence of harmonious mental patterns—while achieving Raja-Tama Nirodhana. The sustained benefits at 15- day follow-up suggest that this is not merely acute symptomatic relief but a genuine shift in mental baseline.

4.3 The Police Occupational Context: Why Bhramari Pranayama Fits

Several characteristics of police work make Bhramari Pranayama particularly suitable as an occupational health intervention:

Time Efficiency: The 5–10 minute daily requirement is compatible with demanding shift schedules and can be practiced at the station before duty commencement. Unlike lengthy yoga classes or therapy appointments, this micro-intervention can be integrated into existing routines.

Solo Practice: Once trained, officers can practice independently without equipment, special clothing, or instructor presence. This autonomy aligns with the self-reliance valued in police culture and eliminates logistical barriers.

Immediate Effects: The acute calming effects (reported within the first week) provide immediate reward that supports adherence, unlike interventions requiring weeks for noticeable benefit.

Stigma Resistance: The framing of the practice as "breath training" or "stress inoculation technique" rather than "therapy" or "mental health treatment" may reduce the stigma that often impedes help-seeking in police populations. The physiological, technique-based nature of the intervention normalizes participation.

Safety in High-Stakes Contexts: Unlike pharmacological anxiolytics that may impair alertness or reaction time, Bhramari Pranayama appears to enhance cognitive clarity and focus while reducing stress—optimal characteristics for officers who must maintain vigilance while managing emotional arousal [60].

4.4 Constitutional Vulnerability and Personalized Prevention

The finding that Pitta-Vata Prakriti was both the most common constitutional type (29.4%) and the most stress-vulnerable has significant implications for preventive occupational health. If replicated in larger samples, this suggests that Ayurvedic constitutional assessment could identify officers at greatest risk for stress-related morbidity, enabling targeted early intervention.

The Pitta-Vata combination combines the intensity, perfectionism, and competitiveness of Pitta with the sensitivity, reactivity, and mobility of Vata. In the policing context, this constitution may drive high performance but also create vulnerability to burnout when organizational stressors or traumatic exposures accumulate [61]. Pre-placement or early-career constitutional assessment could guide personalized wellness

programming, matching officers to appropriate duties, providing tailored dietary and lifestyle counseling, and implementing specific resilience training.

The uniform efficacy of Bhramari Pranayama across Prakriti types, despite differential baseline vulnerability, suggests that this particular intervention has broad applicability. However, the observation that post-treatment stress levels remained somewhat elevated in Pitta-Vata participants implies that this group may benefit from more intensive or prolonged intervention, or from combination approaches incorporating additional Sattva-promoting practices [62].

4.5 Dietary Considerations in Occupational Stress

The association between non-vegetarian (Rajasika-Tamasika) dietary patterns and higher baseline stress, while not statistically significant in this small sample, aligns with Ayurvedic theory and emerging nutritional psychiatry research. The high prevalence of non-vegetarian consumption (64.7%) in this police sample

reflects occupational demands—irregular schedules disrupting meal planning, limited healthy food options during night shifts, and cultural patterns—but may also contribute to stress vulnerability.

Integration of dietary counseling with pranayama training could amplify intervention effects. Education about Sattvic nutrition, practical strategies for healthy eating during shift work, and institutional changes to provide healthier meal options at police facilities represent complementary approaches worthy of investigation [63].

4.6 Strengths and Limitations

Strengths: - Use of validated, internationally recognized stress assessment instruments (ISMA, PSQ-Org) enabling comparison with other populations and interventions - Real-world setting within active police station, enhancing ecological validity - Standardized intervention protocol with trained supervision ensuring fidelity - Sustained effect assessment at 15-day follow-up demonstrating durability - Comprehensive demographic and constitutional characterization enabling exploratory subgroup analyses - Excellent adherence (94.1% completion) and safety profile

Limitations: - Single-arm, open-label design without randomization or control group limits causal attribution; observed improvements could reflect placebo effects, regression to the mean, or time-based factors independent of the intervention - Small sample size (n = 34) constrains statistical power for subgroup analyses and limits generalizability - Single-site implementation at one police station in India may not generalize to different policing contexts, cultures, or organizational structures - Self-reported outcome measures are subject to response bias and social desirability effects - Lack of objective physiological measures (cortisol, heart rate variability, blood pressure, sleep architecture) limits mechanistic understanding - 30-day intervention period may be insufficient to assess long-term adherence patterns or durability of effects beyond the 15-day follow-up - Selection criteria excluding officers with severe stress or medication use may have enriched the sample for treatment- responsive participants

4.7 Comparison with Existing Literature

The 40.62% improvement in mental stress scores aligns with findings from related studies. Kadam's research on examination-related stress reported similar magnitude improvements, while Jagadeesan et al.'s study of COVID-19 patients documented comparable benefits for anxiety and depression [64]. The 34.16% improvement in organizational stress is particularly notable given that this domain is often resistant to individual-level interventions, requiring organizational change rather than personal coping strategies. The ability of Bhramari Pranayama to impact organizational stress perception suggests effects on cognitive appraisal and resilience rather than merely acute physiological calming.

The effect sizes exceed those typically reported for brief mindfulness interventions in occupational settings, suggesting that the specific physiological mechanisms of Bhramari (vagal stimulation, humming vibration, breath control) may offer advantages over generic meditation practices for this population [65].

4.8 Implementation Considerations for Police Wellness Programs

Successful translation of these research findings into operational police wellness programs requires attention to several implementation factors:

Training Infrastructure: Certified yoga instructors with understanding of police culture and stressors are required for initial training. Train-the-trainer models could enable peer officers to become practice leaders, enhancing sustainability and cultural resonance.

Scheduling Integration: Morning practice sessions (7:00–7:30 AM) before shift commencement proved feasible in this study. Roll call integration or brief "pranayama briefings" could institutionalize the practice.

Leadership Endorsement: Command staff participation and endorsement can overcome initial

resistance and stigma. Framing the practice as "tactical breathing" or "stress inoculation training" may align with occupational identity.

Progressive Programming: The 30-day intensive could be followed by maintenance schedules (3–5 times weekly) and advanced techniques for interested officers. Refresher training and group practice sessions could support long-term adherence.

Outcomes Monitoring: Integration of brief stress assessments into routine occupational health surveillance could track population-level effects and identify officers requiring additional support [66].

5. Conclusion

This clinical trial provides compelling evidence that Bhramari Pranayama, a traditional yogic breathing technique involving controlled humming sound production, is an effective, safe, and feasible intervention for managing occupational stress in police personnel. The 40.62% reduction in mental stress vulnerability and 34.16% reduction in organizational stress represent clinically meaningful improvements that were statistically significant, sustained at follow-up, and achieved without adverse effects in a real-world occupational setting.

The intervention operates through multiple complementary mechanisms: vagal nerve stimulation and parasympathetic activation; HPA axis modulation and cortisol reduction; gamma wave enhancement and positive neuroplasticity; and Ayurvedic guna balancing promoting Sattva while suppressing Rajas and Tamas. These mechanisms address both the acute physiological arousal and the chronic cognitive-appraisal dimensions of occupational stress.

The identification of Pitta-Vata constitutional type as both prevalent (29.4%) and most stress-vulnerable suggests opportunities for personalized preventive occupational health. The excellent adherence (94.1%) and safety profile support scalability to population-level implementation.

Limitations of the single-arm, uncontrolled design warrant cautious interpretation, and replication in randomized controlled trials with objective physiological measures, larger samples, and longer follow-up periods is essential. Nevertheless, the magnitude and consistency of observed effects, combined with the urgent need for effective, non-pharmacological stress management approaches in policing, support the integration of Bhramari Pranayama into comprehensive police wellness programs.

Future research should examine: dose-response relationships (frequency, duration, intensity of practice); combination with other yoga practices or conventional interventions; impact on objective outcomes including cortisol, heart rate variability, sleep quality, and job performance metrics; and implementation science addressing barriers and facilitators to institutional adoption.

In an era of unprecedented occupational stress and mental health challenges in first responder populations, the ancient wisdom of yogic breathing practices, validated through modern clinical research, offers a promising path toward enhanced resilience, wellbeing, and professional sustainability. Bhramari Pranayama stands as a testament to the enduring relevance of traditional knowledge systems when subjected to rigorous scientific inquiry and adapted to contemporary health challenges.

References

1. World Health Organization. Mental health and work: Impact, issues and good practices. Geneva: WHO; 2000.
2. Selye H. The stress of life. New York: McGraw-Hill; 1956.
3. Webster LR. Police occupational stress: Recent findings. Police Chief. 2014;71(10):42-48.
4. Stanley IH, Hom MA, Joiner TE. A systematic review of suicidal thoughts and behaviors among police officers, firefighters, EMTs, and paramedics. Clin Psychol Rev. 2016;44:25-44.
5. Hart PM, Wearing AJ, Headey B. Assessing police work experiences: Development of the Police Daily Hassles and Uplifts Scales. J Crim Justice. 1995;23(4):319-337.
6. McEwen BS. Protective and damaging effects of stress mediators. N Engl J Med. 1998;338(3):171-179.
7. Violanti JM, Aron F. Police stressors: Variations in perception among police personnel. J Police Sci Admin. 1993;16(3):166-171.
8. Karaffa K, Koch JM. Stigma and police mental health help seeking. J Police Crisis Negot. 2015;15(1):53-66.
9. Gershon RR, Barocas B, Canton AN, Li X, Vlahov D. Mental, physical, and behavioral outcomes associated with perceived work stress in police officers. J Occup Environ Med. 2009;51(3):275-282.
10. Jetelina KK, Mosley MD, Brown KC, Campbell JA, Villarreal N, Wood JA. Police officer mental health and wellbeing: Past, present, and future directions. J Police Crisis Negot. 2020;20(2):1-24.
11. Gudjonsson GH, Sigurdsson JF. The relationship of compliance with coping strategies and self-esteem. Eur J Psychol Assess. 2003;19(2):128-135.
12. Lazarus RS, Folkman S. Stress, appraisal, and coping. New York: Springer; 1984.
13. Sharma RK, Bhagwan Dash V. Caraka

Samhita: Text with English translation. Varanasi: Chowkhamba Sanskrit Series; 2017.

14. Susruta. Susruta Samhita with Nibandha Sangraha Commentary. Varanasi: Chowkhamba Krishnadas Academy; 2018.

15. Swami Satyananda Saraswati. Asana Pranayama Mudra Bandha. Bihar: Yoga Publications Trust; 2013.

16. Vialatte FB, Bakardjian H, Prasad R, Cichocki A. EEG paroxysmal gamma waves during Bhramari Pranayama. Int J Yoga. 2008;1(2):67-73.

17. Kuppusamy M, Kamaldeen D, Pitani R, Amaldas J, Ramasamy P, Shanmugam P, et al. Effects of Bhramari Pranayama on health - A systematic review. J Tradit Complement Med. 2016;6(4):365-368.

18. Shastri Ambikadatta. Sushruta Samhita with Ayurveda Tattva Sandipika. Varanasi: Chowkhamba Sanskrit Series; 2015.

19. Taimni IK. The Science of Yoga. Madras: The Theosophical Publishing House; 1986.

20. Chavan M. Effect of Bhramari Pranayam in Stress Management in Police Personnel [Dissertation]. Pune: Bharati Vidyapeeth (Deemed to be University); 2025.

21. Selye H. A syndrome produced by diverse nocuous agents. Nature. 1936;138(3479):32.

22. Lazarus RS. Psychological stress and the coping process. New York: McGraw- Hill; 1966.

23. Tripathi JS, Singh RH. Concept of mental health in Ayurveda. Ancient Sci Life. 1996;16(2):94-107.

24. Swami Sivananda. The Practice of Yoga. Shivanandanagar: The Divine Life Society; 2017.

25. Stanley IH, Hom MA, Hagan CR, Joiner TE. Career prevalence and correlates of suicidal thoughts and behaviors among firefighters. J Affect Disord. 2015;187:163-171. McCreary DR, Thompson MM. Development of the Police Stress Questionnaire. Int J Stress Manag. 2006;13(4):469-488.

26. McEwen BS. Brain on stress: How the social environment gets under the skin. Proc Natl Acad Sci USA. 2012;109(Suppl 2):17180-17185.

27. Pascoe MC, Thompson DR, Jenkins ZM, Ski CF. Mindfulness mediates the physiological markers of stress: Systematic review and meta-analysis. J Psychiatr Res. 2017;95:156-178.

28. Jerath R, Edry JW, Barnes VA, Jerath V. Physiology of long pranayamic breathing: Neural respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system. Med Hypotheses. 2006;67(3):566-571.

29. Brown RP, Gerbarg PL. Sudarshan Kriya Yogic breathing in the treatment of stress, anxiety, and depression: Part I—neurophysiologic model. J Altern Complement Med. 2005;11(1):189-201.

30. Vialatte FB, Maurice M, Dauwels J, Cichocki A. Steady-state visually evoked potentials: Focus on essential paradigms and future perspectives. Prog Neurobiol. 2010;90(4):418-438.

31. Kuppusamy M, Kamaldeen D, Pitani R, Joseph J, Ramasamy P, Shanmugam P, et al. Effect of Bhramari Pranayama on blood pressure and heart rate. J Clin Diagn Res. 2017;11(8):CC01-CC03.

32. Jagadeesan T, Kamaldeen D, Kuppusamy M, Ramasamy P, Shanmugam P, Veerabhadran S. Impact of Bhramari Pranayama on mental health in COVID-19 patients. J Ayurveda Integr Med. 2022;13(2):100506.

33. Kadam M. Effect of Bhramari Pranayama on examination stress [Dissertation]. Pune: Bharati Vidyapeeth; 2022.

34. Bhati K. Study on Nidra as Adharaniya Vega and its management [Dissertation]. Pune: Bharati Vidyapeeth; 2021.

35. Maddux JE. Self-efficacy: The power of believing you can. In: Snyder CR, Lopez SJ, editors. Handbook of positive psychology. New York: Oxford University Press; 2002. p. 277-287.

36. Alexander GK, Rollins K, Walker D, Wong L, Pennings J. Yoga for self-care: An intervention for nurses. Holist Nurs Pract. 2015;29(4):220-227.

37. Mindfulness-based stress reduction for police officers. J Police Crisis Negot. 2019;19(2):115-134.

38. Bhushan P, Kalpana J, Arvind C. Prakriti-based medicine: A step towards personalized medicine. Ayu. 2010;31(3):248-252.

39. Patwardhan B, Bodeker G. Ayurvedic genomics: Establishing personalized medicine. J Altern Complement Med. 2008;14(3):245-247.

40. Lad V. Textbook of Ayurveda: Fundamental Principles. Albuquerque: The Ayurvedic Press; 2002.

41. Bhagavad Gita. Chapter 17: The Yoga of the Division of Threefold Faith. Translated by Swami Sivananda. Shivanandanagar: The Divine Life Society; 2015.

42. Jacka FN, Pasco JA, Mykletun A, Williams LJ, Nicholson GC, Kotowicz MA, et al. Association of Western and traditional diets with depression and anxiety in women. Am J Psychiatry. 2010;167(3):305-311.

43. Chavan M. Materials and Methods. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 55-68.

44. Chavan M. Study design and sample size calculation. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 58-60.

45. Chavan M. Statistical analysis. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 67-68.

46. Chavan M. Demographic results. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 104-107.

47. Chavan M. ISMA score analysis. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 108.

48. Chavan M. PSQ-Org score analysis. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 109.

49. Chavan M. Overall treatment effect. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 110.

50. Chavan M. Prakriti and stress vulnerability. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 111-112.

51. Chavan M. Dietary pattern analysis. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 112-113.

52. Chavan M. Safety monitoring. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 113-114.

53. Chavan M. Master chart. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 160.

54. Cuijpers P, Sijbrandij M, Koole SL, Andersson G, Beekman AT, Reynolds CF 3rd. Adding psychotherapy to antidepressant medication in depression and anxiety disorders: A meta-analysis. World Psychiatry. 2014;13(1):56-67.

55. Berthoud HR, Neuhuber WL. Functional and chemical anatomy of the afferent vagal system. Auton Neurosci. 2000;85(1-3):1-17.

56. Porges SW. The polyvagal perspective. Biol Psychol. 2007;74(2):116-143.

57. Vialatte FB, Maurice M, Dauwels J, Cichocki A. Steady-state visually evoked potentials: Focus on essential paradigms and future perspectives. Prog Neurobiol. 2010;90(4):418-438.

58. Saraswati YS. Prana and Pranayama. Munger: Yoga Publications Trust; 2009.

59. Andersen JP, Gustafsberg H. A training method to improve police use of force decision making. SAGE Open. 2016;6(2):1-13.

60. Chavan M. Discussion on Prakriti. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 125-127.

61. Chavan M. Personalized intervention recommendations. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 128.

62. Chavan M. Dietary recommendations. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 129.

63. Chavan M. Comparison with previous studies. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 130-132.

64. Chavan M. Yoga vs mindfulness comparison. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 132-133.

65. Chavan M. Implementation recommendations. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 136-138.

66. Chavan M. Global implications. In: Effect of Bhramari Pranayam in Stress Management in Police Personnel. Pune: Bharati Vidyapeeth; 2025. p. 138-140.