



Short Review

Bhramari Pranayama – A simple lifestyle intervention to reduce heart rate, enhance the lung function and immunity

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ARTICLE INFO

Article history:

Received 29 September 2020

Received in revised form

27 April 2021

Accepted 5 July 2021

Available online 5 August 2021

Keywords:

Bhramari

Heart rate variability (HRV)

Resting heart rate (resting HR)

Immune function

Lifestyle

Nitric oxide

Humming

ABSTRACT

Individuals with chronic diseases have a higher risk of infection and show lung function impairment. Poor lifestyle choices such as physical inactivity, poor diet, stress, excess tobacco, and alcohol, and sleep disruption increase the risk of chronic inflammation and immune impairment but the evidence does not quantify the specific risk factor(s) and their correlation with the immune system impairment. COVID-19 related uncertainty has created a more urgent need to understand the need to identify interventions that could help in managing the risk factors, especially for healthy individuals who are at a higher risk of infection and/or immune system impairment. The role of three parameters, the Resting Heart Rate (HR), increased Heart Rate Variability (HRV), and lung function is considered as risk factors for systemic inflammation and chronic diseases. The evidence on *Bhramari Pranayama* is presented for possible lifestyle interventions to reduce the risk of infection, increase lung function, enhance autonomic function, and improve sleep quality in healthy individuals.

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1. Risk factors for immune system impairment and chronic disease

The global COVID-19 pandemic has highlighted the importance of immune response, specifically in individuals with chronic disease due to higher mortality risk [1]. Poor lifestyle choices such as physical inactivity, poor diet, stress, excess tobacco, excessive alcohol, and sleep disruption play an important role in autonomic dysfunction, systemic (low grade) inflammation, immune impairment – leading to mental and physical health conditions [2–4]. The research over the past two decades has confirmed the role of immune and inflammatory processes in several chronic conditions such as ischemic heart disease, stroke, cancer, diabetes mellitus, chronic kidney disease, non-alcoholic fatty liver disease (NAFLD), chronic obstructive pulmonary disease (COPD), and auto-immune and neurodegenerative conditions (together referred to as “*chronic disease*” in this article) [5,6]. Reduced lung function is also associated with systemic inflammation and diseases such as diabetes or heart disease [7–9]. The linkage between systemic inflammation

and impaired immunity is also well-documented [10,11]. The inflammatory and immune markers in chronic disease subjects are correlated and can be used to differentiate between preclinical and clinical phases of the disease, complications, and progression [12]. Finally, an impaired immune system increases the infection risk and the presence of a chronic disease further impairs the immune system [13].

2. Complex relationship between risk factors and infection risk

Research has yet to establish a quantitative relationship between altered immune response and frequency or severity of disease due to confounding factors such as genetic dissimilarity, lifestyle choices, and environmental exposure [14,15]. Despite the evidence of the risk factors impairing the immune system, it is not possible to isolate any specific risk factor(s) that could be leveraged for enhancing the immune system. Hence, the lifestyle intervention must address all the risk factors to increase the probability of improving the immune system function, which is not practical. Being able to identify a simple intervention that could have a significant influence on the risk factors could be of great importance as a public health intervention [2].

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Peer review under responsibility of Transdisciplinary University, Bangalore.

3. Resting Heart Rate (HR), Heart Rate Variability (HRV), and the lung function in chronic disease subjects

The evidence highlighting the correlation between resting HR, HRV, lung function, and chronic disease is captured below:

1. Increased resting HR and reduced HRV are linked to increased inflammatory biomarkers in healthy adults as well in chronic disease conditions [3,16,17]. Increased resting HR and reduced HRV also point to increased mortality risk in healthy and chronic disease subjects [18]. The majority of chronic diseases, neuropsychiatric diseases, and cancer are associated with increased resting HR and decreased HRV [3]. Therefore, a solution that enhances the HRV and reduces the resting HR could be of value for preventing and managing several pre-disease or chronic disease conditions in healthy individuals.
2. There is sufficient evidence of the association between specific HRV parameters (e.g. standard deviation of normal to normal R-R or beat-to-beat intervals or SDNN and power in the high-frequency band or HF-HRV) and inflammatory markers as compared to other HRV time and frequency domain measures [19]. Several studies have identified the vagus nerve activity, even after adjusting for the sympathetic nervous system activity, showing an inverse relationship between HF-HRV and several inflammatory markers. This correlation is not limited to healthy individuals but is seen even in chronic disease conditions [20]. Therefore, any lifestyle choice that enhances HRV could influence physiological and emotional health [21].
3. Robust lung function is critical for all chronic diseases. The evidence confirms a significant rate of decline in lung function for diabetes subjects even after eliminating the impact of other factors such as smoking [7]. Findings are similar about lung function impairment and other chronic diseases such as heart-disease including hypertension, as well [22]. The findings also highlight the increased risk of chronic disease incidence in subjects with poor lung function [8]. Therefore, an intervention that could increase the lung function could be of value as a preventive lifestyle intervention for healthy adults.

4. A lifestyle intervention to reduce HR, increase HRV, and enhance the lung function

Given the inability to identify specific risk factor(s) to enhance the immune system, the suggestion is to explore activities that influence the changes in the intermediate measures (i.e., reduce HR, increase HRV, and influence the lung function) since it could be beneficial to enhance the immune system through reduced inflammation. While the data supports that the majority of healthy lifestyle choices reduce chronic inflammation thereby enhancing the immune system, a specific mind-body intervention that could support a reduction in HR, increase in HRV, and enhancement in lung function can be of great value for individuals at risk for chronic diseases or with chronic diseases.

5. Case for adding *Bhramari Pranayama* as a lifestyle intervention

Evidence on yogic practices, specifically *Bhramari Pranayama* (humming bee breathing) indicates a possible solution for reducing HR, increasing HRV, and also enhancing lung function in healthy individuals [23,24]. Research on *Bhramari Pranayama* has demonstrated a significant reduction in HR, increase in HRV, and an increase in lung function – denoting increased relaxation response after 10–20 min of daily practice for at least 4–6 weeks [25–27]. *Bhramari Pranayama* incorporates many benefits of *Pranayama* via

slow breathing since it involves slow inhalation followed by even longer exhalation while making the humming sound. The humming sound resembles repetitive mantra chanting practice which provides significant benefits on the physiological systems. Evidence indicates that regular use of such practice may lead to changes in resting respiratory sinus arrhythmia) and improved baroreceptor activity with positive autonomic effects similar to those observed with HRV biofeedback training and regular yoga practice [28,29]. Scientific research has recommended slow breathing as adjunctive therapy for insomnia and it is well-established that poor sleep impairs the autonomic nervous system and the impaired autonomic nervous system adversely impacts the sleep quality [30]. Regular practice of *Bhramari Pranayama* has demonstrated a positive impact both on sleep and the autonomic nervous system via increased parasympathetic dominance. Finally, there is emerging evidence of the positive impact of *Bhramari* due to increased expression of nitric oxide (NO) and its impact on oxygen uptake. Human paranasal sinuses produce a large amount of NO continuously and humming sound vibrations create air oscillations which in turn increase the exchange of air between the sinuses and the nasal cavity [31]. Recent findings indicate that increased nasal NO could play an important role in the prevention and management of COVID-19 since NO is anti-inflammatory and contributes to non-specific host defense against bacteria, viral, fungal, and parasite infections [32,33].

Together, the above evidence provides a very strong case for integrating *Bhramari Pranayama* into daily practice for healthy individuals. The use of slow and coherent breath, coupled with humming sound vibrations result in several mind-body benefits related to the autonomic nervous system enhancement, cardiovascular parameters including reduced blood pressure, enhancement in lung function, and increased attention. Our review of the literature indicates an opportunity to study the impact of such practice on healthy individuals who have increased risk for chronic disease or on subjects with chronic disease. Integrative medicine practitioners could explore how such practice can be integrated into a lifestyle intervention through public health initiatives for disease prevention and improvement in the quality of life.

6. Conclusion

Given the simplicity of practice and potential benefits through positive impact on HR, HRV, lung function, autonomic function, attention, and sleep quality, *Bhramari* practice promises to be a very powerful public health intervention. This simple practice helps decrease HR, increase HRV, and improve lung function for both healthy and chronic disease subjects (excluding cancer and chronic kidney disease where the lung function could already be impaired, making it difficult to do the practice). Integrative medicine practitioners could consider incorporating *Bhramari Pranayama* as a lifestyle intervention and explore additional research in this area (such as the impact on inflammation, immune markers, cortisol).

Source(s) of funding

None.

Conflict of interest

None.

Acknowledgements

None.

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