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## Review article

Effects of *Bhramari Pranayama* on health – A systematic reviewMaheshkumar Kuppusamy<sup>a,\*</sup>, Dilara Kamaldeen<sup>a</sup>, Ravishankar Pitani<sup>b</sup>, Julius Amaldas<sup>c</sup>, Poonguzhali Shanmugam<sup>d</sup><sup>a</sup> Department of Physiology, Sri Ramachandra Medical College and Research Institute, Chennai, India<sup>b</sup> Department of Community Medicine, Ramachandra Medical College and Research Institute, Chennai, India<sup>c</sup> Department of Biochemistry, Sri Balaji Dental College and Hospital, Bharath University, Chennai, India<sup>d</sup> National Institute for Research in Tuberculosis (formerly Tuberculosis Research Centre), ICMR, Chennai, India

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## ABSTRACT

**Background:** Pranayama, a branch of yoga practice is extremely beneficial to mankind in maintaining sound physical and mental health and this article aims to attain an insight on the studies conducted on the effectiveness of *Bhramari Pranayama* (Bhr.P) on health. The studies done until May 2016 were found using Medline, Embase, Google scholar and manual search. Studies conducted on the health effectiveness of Bhr.P specifically were included on the basis of prisma guidelines. The data were defined by their objectives, methodology, study setting, findings, interventions done and implications suggested in the study. Methodological Quality Rating Scale (MQRS) and Newcastle-Ottawa Scale (NOS) were used in reviewing and reporting results of the included studies. 6 studies satisfied the inclusion criteria; 2 studies were done on the cold pressor test, one on heart rate and BP, one on EEG changes, one each on the inhibitory response and tinnitus condition. In the included studies, the Bhr.P practices have shown parasympathetic dominance. There are some encouraging effects of Bhr.P on various physiological systems. Methodological quality of the included studies was evaluated to be very low and none of them were RCTs. Yet the available studies are heterogeneous, dealing in different grounds and this heterogeneity serves as a resource for the limited scope of studies on Bhr.P. Therefore, further large-scale, properly designed, randomized trials of Bhr.P on various systems have to be done to justify these effects efficiently. © 2017 Center for Food and Biomolecules, National Taiwan University. Production and hosting by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Yoga is an ancient Indian science that designs way of life with its various practices. It is being practiced in the form of *Asana* (Posture), *Pranayama* (breathing manipulation), *Meditation* (concentration technique) etc by the practitioners in range of methods and style.<sup>1</sup> *Pranayama* is one practice that has been found to be effective to physiology of mankind in many ways. The Sanskrit word *Pranayama* contains two segments namely *Prana* (means vital force) and *Yama* (means control).<sup>2</sup> It literally means a yogic act performed for controlling the flow of vital energy that governs all the physiological process in the body. *Maharishi Patanjali*, in his

*Ashtanga yoga*, has given more importance to pranayama than asana for good health.<sup>3</sup> *Pranayama* consists of three phases: *Purak* (inhalation), *Kumbhak* (retention) and *Rechak* (exhalation).<sup>2</sup> These can be practiced either alone or with combination which depends upon the type of pranayama. In human beings, the breath is an active connection between the body and mind while the *Pranayama* is considered as manipulation of one's own breathing.<sup>4</sup> Different types of pranayama produce specific physiological responses and it greatly depend on type and duration of the practice.<sup>5–7</sup> *Nadisuddhi*, *Savitri*, *Kapalbhati*, *Bhasrika*, *Bhramari Pranayama*, and so on are well known among them.

*Pranayama*, by continuous practice reduces the dead space ventilation and decreases the work of breathing. Entire lung is ventilated in contrast to the shallow breathing which only refreshes the base of the lung.<sup>8</sup> Practicing pranayama regularly has a positive impact on cardiovascular,<sup>9,10</sup> and respiratory functions,<sup>11,12</sup> improves the autonomic system towards parasympathetic (vagal tone) dominance.<sup>13,14</sup> This in turn reduces the effects of stress and

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strain on various systems. Hence the overall physical and mental health improves.<sup>15</sup> Each style of pranayama has its own beneficial effect based on the breathing cycle, tidal volume and other factors like the use of mouth, nostrils, constriction of laryngeal muscles and position of the glottis.<sup>16</sup> The *Bhramari* is one type of pranayama. Its simplicity of slow breathing and that it could be easily practiced by everyone irrespective of their age or gender makes it notifiable. In Bhr.P, the practitioner will sit in any comfortable posture and inhale and exhale through nostrils slowly and deeply. While exhaling, will have to produce sound (humming sound) like bumble bee strictly through nasal airways, keeping oral cavity closed by the lips, ears closed by fingers.<sup>17</sup>

When we look into the benefits of this pranayama, the self induced humming sound in this practice resembles mantra repetition technique. Bhr.P changes the normal breathing rhythm, with prolonged exhalation and short inhalation, which produces significant impact in physiological system.<sup>18</sup> Practice of Bhr.P for 5–10 min continuously induce subjective feelings of mind refreshment and blissfulness and sometimes the subjects are believed to go to even meditative state.<sup>19</sup> So Bhr.P technique is not only a breathing practice but also a form of meditation. As compared with other pranayama, it does not have any kind of breath holding or alternate nostril involvement with counting. Added to above, the humming sound which is produced during the breathing gives more attraction and interest to the subjects for practicing the pranayama. In this, it's very convenient to control and check the correctness by the sound of humming which is produced by the pranayama practitioners.

It has been reported that Bhr.P practice is effective for correcting the hormonal imbalance conditions and other disorders like hypertension, anxiety, and depression. The calming effect of the Bhr.P helps in overcoming drug dependency.<sup>20</sup> However very few scientific studies on the effects of this technique have been done so far.

### 1.1. Need for the review

There are many benefits for pranayama and there have been many studies conducted experimenting these benefits, still there is very few documentation on specific pranayama individually. The Bhr.P is one such technique that has many health benefits but very little scientific evidence showing its effects. Most of the literatures available are the shared effects of pranayama practices as a whole and there is no backup for Bhr.P individually. In this review, we wanted to explore the existing scientific studies on the Bhr.P. Hence we have systematically reviewed the available studies on the benefits of Bhr.P to assess how the studies have been done and what are the benefits of Bhr.P addressed in them. This review could lead in further identifying the gaps in the existing studies as well as exploring the new floor for scientific advances in this field.

## 2. Methodology

This systematic review has been conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Prisma) guidelines.

### 2.1. Search criteria

The search was done online in Medline, Embase, google scholar and manual search also carried out till May 2016 to make the search exhaustive and identified all the studies done on the effects of Bhr.P. The key words used were pranayama, *Bhramari* pranayama, tranquilizing pranayama, humming pranayama, benefits, effects, practice of *Bhramari*. The words with similar meaning of the key words were also used for the search. Zotero, open source reference

management software, was used to cite and manage the data by online library program.<sup>21</sup>

### 2.2. Selection of studies

The selection of studies was done on the basis of inclusion and exclusion criteria.

**Inclusion criteria:** The studies done specifically on Bhr.P and its benefits. General effects, specific health benefits, systemic effects of Bhr.P were included.

**Exclusion criteria:** The studies that have been done on Bhr.P in combination with any other practice were excluded.

### 2.3. Data extraction

After the exhaustive search and selecting the studies on the basis of inclusion criteria, the data extraction was done by two reviewers independently and disagreements were resolved by discussion. Then the final set of manuscripts was assessed as a team by the authors and information was thematically extracted. The data extracted include the objective of the study, the methodology employed, the study setting, salient findings, any interventions performed and implications or recommendations resulting from the study findings.

Then the studies were assessed for their quality and rated by Methodological Quality Rating Scale (MQRS)<sup>22</sup> and Newcastle-Ottawa Scale (NOS).<sup>23</sup> Four dimensions of methodological quality were assessed by MQRS scale and based on that all the included studies were scored which has the range from minimum of 1 (extremely poor quality) to maximum of 16 (extremely good quality). Three aspects were considered in the NOS criteria: (1) subject selection: 0–4; (2) subject comparability: 0–2; and (3) clinical outcome: 0–3. NOS scores range from 0 to 9; a score  $\geq 7$  indicated that the study was of good quality.

### 2.4. Data synthesis

Following the data extraction, the data synthesis was done by categorizing the study findings under pulmonary effects, cardiovascular effects and autonomic system. The number of studies was limited and was summarized using a narrative approach and hence meta-analysis could not be done.

## 3. Results

A Prisma flow diagram (Fig. 1) completely depicts the search process and study selection. Following the search through various search engines, 25 papers were derived. Eliminating the duplicates, 19 studies arrived. By reading through the title and abstracts of these 19 papers, the papers dealt with effects of pranayama in general, conference papers, other pranayama papers, and effects of Bhr.P in combination with other practices were eliminated and finally 6 studies satisfied the inclusion criteria and were included for the review. The final included papers describe about the effectiveness of Bhr.P in various physiologic functions. They have been widely distributed all over Indian sub-continent. The included papers are described in detail. (Table 1) Out of the included studies, 2 studies done on the cold pressor,<sup>24,25</sup> one on heart rate and BP,<sup>26</sup> one study on EEG changes,<sup>27</sup> each on the inhibitory response<sup>28</sup> and tinnitus condition.<sup>29</sup> Hence they were broadly categorized under pulmonary, cardiovascular, autonomic and others on the basis of their physiologic effects.

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