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Immediate Effect of Slow Pace *Bhastrika Pranayama* on Blood Pressure and Heart Rate

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Abstract

Objectives: The objective of this study was to evaluate the immediate effect of slow pace *bhastrika pranayama* (respiratory rate 6/min) for 5 minutes on heart rate and blood pressure and the effect of the same breathing exercise for the same duration of time (5 minutes) following oral intake of hyoscine-*N*-butylbromide (Buscopan®), a parasympathetic blocker drug.
Subjects and methods: Heart rate and blood pressure of volunteers ($n = 39$, age = 25–40 years) was recorded following standard procedure. First, subjects had to sit comfortably in an easy and steady posture (*sukhasana*) on a fairly soft seat placed on the floor keeping head, neck, and trunk erect, eyes closed, and the other muscles reasonably loose. The subject is directed to inhale through both nostrils slowly up to the maximum for about 4 seconds and then exhale slowly up to the maximum through both nostrils for about 6 seconds. The breathing must not be abdominal. These steps complete one cycle of slow pace *bhastrika pranayama* (respiratory rate 6/min). During the practice the subject is asked not to think much about the inhalation and exhalation time, but rather was requested to imagine the open blue sky. The *pranayama* was conducted in a cool, well-ventilated room (18–20°C). After 5 minutes of this breathing practice, the blood pressure and heart rate again were recorded in the aforesaid manner using the same instrument. The other group ($n = 10$) took part in another study where their blood pressure and heart rate were recorded following half an hour of oral intake of hyoscine-*N*-butylbromide 20 mg. Then they practiced the breathing exercise as stated above, and the abovementioned parameters were recorded again to study the effect of parasympathetic blockade on the same *pranayama.*
Results: It was noted that after slow *bhastrika pranayamic* breathing (respiratory rate 6/min) for 5 minutes, both the systolic and diastolic blood pressure decreased significantly with a slight fall in heart rate. No significant alteration in both blood pressure and heart rate was observed in volunteers who performed the same breathing exercise for the same duration following oral intake of hyoscine-*N*-butylbromide.
Discussion: *Pranayama* increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors during above tidal volume inhalation as in Hering Bruer reflex, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatation, thus causing decrease in peripheral resistance and thus decreasing the diastolic blood pressure. After hyoscine-*N*-butylbromide, the parasympathetic blocker, it was observed that blood pressure was not decreased significantly as a result of *pranayama*, as it was observed when no drug was administered.
Conclusions: Vagal cardiac and pulmonary mechanisms are linked, and improvement in one vagal limb might spill over into the other. Baroreceptor sensitivity can be enhanced significantly by slow breathing (supported by a small reduction in the heart rate observed during slow breathing and by reduction in both systolic and diastolic pressure). Slow pace *bhastrika pranayama* (respiratory rate 6/min) exercise thus shows a strong tendency to improving the autonomic nervous system through enhanced activation of the parasympathetic system.

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Introduction

Stress, a part and parcel of our daily life, has many biologic effects.[1] To combat stress, many ways can be adopted (e.g., regular physical exercise, change of lifestyle, change of food habit, etc.).[2] According to many, yoga and *pranayama* (breathing exercises) can be practiced to combat stress.[3,4] It has been reported earlier that yoga and *pranayama* are beneficial for the treatment of cardiopulmonary diseases, autonomic nervous system imbalances, and psychologic or stress-related disorders.[3,5] Slow *pranayamic* breathing is reported as one of the most practical relaxation techniques. *Pranayama* (breathing exercise) is known as a part of yogic techniques followed in ancient India. *Pranayama* is defined as a manipulation of breath movement. Different types of *pranayamas* produce different physiologic responses in normal young volunteers. *Savitri pranayama*, *kapalbhati, bhasrika, nadisnddhi pranayama*, and so on are well known among them. Most of the studies report the effect of different *pranayamas*, yogic postures, meditation, and so on collectively and the effect of regular practices of all these for a period of time, (e.g., 1 month, 3 months, etc.). In the present study, the immediate effect of a simple breathing exercise (*bhastrtika pranayama* in slow pace) for 5 minutes' duration on blood pressure and heart rate has been represented.

Subjects and Methods

Healthy, nonsmoker, sedentary volunteers ($n = 39$, age 25–35 years) took part in this study. The aims and objectives were explained and verbal consent was taken. Heart rate and blood pressure were recorded by using a mercury sphygmomanometer following 5 minutes rest.[7,8] The breathing technique was demonstrated to them. First, one has to sit comfortably in an easy and steady posture (*sukhasana*) on a fairly soft seat placed on the floor and keeping the head, neck, and trunk erect and in a straight line, with eyes closed. One should keep the body still during the breathing practice. The back muscles should not remain very stiff and he/she should try to keep the other muscles also loose. Then the subject is directed to inhale through both the nostrils slowly up to the maximum for about 4 sec. The breathing must not be abdominal. Then subject was instructed to exhale slowly up to the maximum through both the nostrils for about 6 sec. These steps complete one cycle of *Bhastrika* (slow pace) *pranayama* (respiratory rate 6/min).[9] During the practice the subject is asked not to think much about the inhalation and exhalation time; rather, he/she was requested to imagine the open blue sky. The *pranayama* was conducted in a cool, well-ventilated room (18–20°C). After 5 minutes of this breathing practice, the blood pressure and heart rate were recorded again in the aforesaid manner using the same instrument. After the breathing exercise they were asked about their feeling. Some answered that they were feeling calm; some felt sleepy; some felt very light and calm.

Another group of participants ($n = 10$) were asked to take hyoscine-*N*-butylbromide (Buscopan®; Boehringer Ingelheim, Ingelheim, Germany) 20 mg orally and after half an hour, the blood pressure and heart rate were recorded. Then they practiced the breathing exercise as stated above and the abovementioned parameters were recorded again to study the effect of parasympathetic blockade on the same *pranayama.*

Results

It was noted that after slow *Bhastrika pranayamic* breathing (respiratory rate 6/min) for 5 minutes, both the systolic and diastolic blood pressure decreased significantly with a slight fall in heart rate (Table 1).

The group of volunteers whose heart rate and blood pressure were compared before and after breathing exercise following the intake of hyoscine-*N*-butyl bromide showed no significant alteration in both of the parameters (Table 2).

Discussion

Pranayama increases frequency and duration of inhibitory neural impulses by activating stretch receptors of the lungs during above tidal volume inhalation as in Hering-Breuer reflex.[10] Inhibitory impulses, produced by slowly adapting receptors in the lungs during inflation,[11] play a role in controlling typically autonomic functions such as systemic vascular resistance and heart rate.[12]

Inhibitory current synchronizes rhythmic cellular activity between the cardiopulmonary center[13] and the central ner-

Table 1. Effect of Slow Pace *Bhastrika Pranayama* (5 Minutes) on Blood Pressure and Heart Rate

Conditions	*SBP (mm Hg)*	*DBP (mm Hg)*	*HR (cycle/minute)*
Baseline ($n = 39$)	115.43 ± 10.79	77.23 ± 7.50	74.23 ± 9.57
After *bhastrika pranayama* for 5 minutes	107.84 ± 9.85*	73.17 ± 6.53*	71.48 ± 8.03

*$p < 0.05$.
SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

Table 2. Effect of 5 Min Slow Pace *Bhastrika Pranayama* on Blood Pressure and Heart Rate Following Hyoscine-*N*-Butylbromide (Buscopan®) Intake

Conditions	*SBP (mm Hg)*	*DBP (mm Hg) HR*	*HR (cycle/minute)*
Baseline ($n = 10$)	112.80 ± 6.19	78.60 ± 8.99	71.8 ± 9.01
After *bhastrika pranayama* for 5 minutes	110.60 ± 6.09	80.60 ± 7.05	73.20 ± 5.43

SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

vous system.[14] Inhibitory current regulates excitability of nervous tissue[15] and is known to elicit synchronization of neural elements, which typically is indicative of a sate of relaxation.[16] Synchronization within the hypothalamus and the brainstem[17] is likely responsible for inducing the parasympathetic response[18] during breathing exercises.

According to the hypothesis of Jerath et al.,[10] blockade of inhibitory signals during activation of lung stretch receptors would likely show a decrease in the parasympathetic effect of slow *pranayamic breathing*. After hyoscine-*N*-butylbromide, the parasympathetic blocker, it was observed that blood pressure was not altered (decreased) significantly as a result of *pranayama*, as it was observed when no drug was administered, supporting the hypothesis of Jerath et al.[10]

Diastolic blood pressure depends upon peripheral resistance, and lung inflation has been known to decrease systemic vascular resistance.[19] This response is initiated by pulmonary stretch receptors, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatations, thus causing a decrease in peripheral resistance[20] and decreasing the diastolic blood pressure.

Vagal cardiac and pulmonary mechanisms are linked, and there are reasons to expect that improvement in one vagal limb might spill over into the other. It has been suggested that chronic biofeedback-induced increases in baroreceptor gain reflect neuroplasticity.[21] Baroreceptor sensitivity can be enhanced significantly by slow breathing. This seems to occur through a relative increase in vagal activity, as could be argued by the small reduction in the heart rate observed during slow breathing and by reduction in both systolic and diastolic pressure.[22]

Most of the volunteers felt calmness of mind, a sense of well-being, and some felt sleepy, thus supporting parasympathetic stimulation. This may be the effect of increased melatonin production after a regimen of slow breathing *pranayamic* exercises.[5] Slow *pranayamic* breathing was also reported to elicit ä-waves, indicating a parasympathetic dominance[23] and may be the cause of the sleepy feeling.

Slow-pace *bhastrika pranayama* (respiratory rate 6/min) exercise thus shows a strong tendency of improving or balancing the autonomic nervous system through enhanced activation of the parasympathetic system and thus can be practiced for mental relaxation and reduction of stress of in daily life.

Disclosure Statement

No competing financial interests exist.

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