

# Bhastrika Pranayama and Heart Rate Variability

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## ABSTRACT

**Background:** Yoga is ancient heritage of India that has given man the answers to his spiritual and holistic search for perfect health and well-being. Pranayama, the fourth limb of ashtanga yoga, plays a significant role in maintaining the autonomic functions of an individual. In today's world of cut throat competition everyone is striving hard to live a natural, healthy and stress free life. Pranayama is a simple and easier way through which one can reduce all his stress, tension and live a healthier disease free life.

**Aim:** To elucidate the effect of bhastrika pranayama on heart rate variability.

**Material and methods:** The study included thirty medical students both male and female of age group 17-21 years. Students practiced bhastrika pranayama twenty five minutes daily for three months. Heart Rate Variability (HRV) is measured before, at 6 weeks and at 12 weeks of pranayama practice. Parameters included in the study were High Frequency Component (HF), Low Frequency Component (LF) and LF/HF

**Results:** There occurs an insignificant increase in HF component and an insignificant decrease is observed in LF component and LF/HF.

**Conclusion:** Bhastrika pranayama plays a role in altering the various cardio-vascular functions of an individual. Thus helps in improving the quality of life.

**Key Words:** HF, HRV, LF, LF/HF, Bhastrika Pranayama.

## INTRODUCTION

The word yoga is derived from Sanskrit word "Yuj" that means "union". It causes union of soul (atma) with the god (parmatma). Also Yoga is a characteristic way that helps in maintaining the balance between health and harmony. [1,2] It has a beneficial effect on our body if practiced regularly. Patanjali has described eight-limbs of yoga (ashtang yog). Role of different limbs of yoga are: The first two limbs of ashtang yoga are "Yam" and "Niyam" which are universal morality and personal discipline for the development of our moral, spiritual and social aspects. Third and fourth limbs are "Asan" and "Pranayam" which help in our physical

development and improvement of physiological functions and breath control. Fifth and sixth limbs are "Pratyahar" and "Dharna" for controlling our senses and making our mind one-pointed, calm and alert. The last two limbs are "Dhyan" and "Samadhi" which cause inner peace, ecstasy, higher level of consciousness and the ultimate union of our individual consciousness with the Universal Consciousness, resulting in God realization. [3]

Due to increased modernization and industrialization, there has been increased stress which causes deterioration of various body functions. There occurs a significant increase in cardiovascular disorder due to

autonomic imbalance by increase stressors. [4-5]

Pranayama is a part of the ancient Indian art of yoga, which is the fourth limb of ashtang yoga. It is a controlled and conscious breathing exercise which involves mental concentration. The word Pranayama is derived from two words i.e. "Prana" meaning vital force or life and "Ayama" meaning to control the vital force. Hence pranayama means control of the vital force by concentration and regulated breathing. There are many type of pranayama some common ones are bhastrika, kapalabhati and nadi shodan pranayama. [6]

Regular practice of pranayama produces a change in various body functions either significant or non significant. Very few studies are available in the literature that shows the effect of particular pranayama on Heart Rate Variability (HRV). So we planned to elucidate the effect of fast breathing pranayama on HRV in students.

## **MATERIALS AND METHODS**

The present study was conducted in the department of Physiology at Pt. B.D. Sharma PGIMS, Rohtak on medical and para-medical students. Thirty students both male and female of 17 to 21 years of age were enrolled randomly in the study which practiced bhastrika pranayama for 12 weeks.

### **Inclusion Criteria**

1. Healthy medical and paramedical students of either sex between 17 and 21 years of age.
2. Students who have not practiced pranayama before enrollment.
3. Students who were committed to practice pranayama as taught by the instructor regularly.

### **Exclusion Criteria**

1. History of smoking and alcohol intake
2. Subjects on long term medications or suffering from any chronic disease including neuromuscular or skeletal disorder.
3. Subjects who do not practice pranayama regularly during the study.

Bhastrika pranayama was performed by subjects as instructed by a certified yoga teacher as detailed below.

For performing bhastrika pranayama subjects were asked to sit in vajrasana keeping the back, neck and head straight. Arms were folded at the elbows and kept on either side of the body with medial side of each arm touching the chest; fists were closed and pointed upwards. Keeping the mouth closed a deep inhalation was taken through nose along with raising the arms parallel to each other above the head and opening the fist. After the inhalation the subjects were instructed to exhale fully and forcibly through nose along with pulling the arms down to the same initial position. One inhalation and exhalation completes one cycle of bhastrika. One set consist of twenty such cycles. The subjects performed two such sets with an interval of four minutes. Between the sets the subjects were asked to sit in vajrasana with eyes closed and hands resting on thighs palms facing towards the sky. Completing both the sets took approximately 25 minutes. [7]

The pranayamic breathing was practiced early in the morning after a warm up for ten minutes by jumping and jogging on the spot. Subjects practiced pranayama with empty stomach or if required only a glass of water was allowed 30 minutes before starting pranayama. Subjects were required to wear light & comfortable clothing.

### **Heart Rate Variability**

Heart Rate Variability was recorded by Lab Chart 7 Pro version 7.3.1 software and hardware supplied by AD Instruments, Australia. It was assessed by frequency domain methods. Subject was made to lie down in supine position on a cushioned couch. Three electrodes were attached, one each to palmar side of left wrist, palmar side of right wrist and just above the medial malleolus of left leg. The subject was asked to relax for about two minutes. An artifact free 5 minutes recording of lead II of E.C.G was taken. Recordings with artifacts were excluded for computing the HRV. [8] The

following parameters were computed for the study.

High Frequency components in normalized unit (nu).

Low Frequency components in normalized unit (nu).

LF/HF ratio.

The following settings were used for recording.

Sampling Rate- The sampling rate in our machine was 256 Hz.

Filters- High Filter- 99 Hz

Low Filter- 0.1 Hz

### Statistical analysis of data

For interpretation of the results the data set of each group was analysed statistically. To study the effect of slow breathing pranayama on HRV over the time, repeated measure ANOVA was used. Significance of results was predicted based on p value. p value > 0.05 was taken as nonsignificant, p value < 0.05 was taken as significant and p value < 0.01 was taken as highly significant.

## RESULTS

The present study was conducted in the department of Physiology at Pt. B.D. Sharma PGIMS, Rohtak on medical and para-medical students. The study was carried out on 30 students of 17-21 years of age of either sex. Their HRV was recorded at basal, 6 weeks and 12 weeks. The observations and results of our study are discussed in the following section:

Table 1: Effect of Bhastrika Pranayama on HF Component

HF	N	Mean	S.D.
BASAL	30	49.384	± 5.503
6 WEEK	30	49.648	± 5.804
12 WEEK	30	49.666	± 6.166

p value >.05, repeated measure ANOVA

Table 1 shows the effect of bhastrika pranayama on HF component of HRV in relation to time. There was a linear increase in HF component of HRV from basal  $49.384 \pm 5.503$  to  $49.648 \pm 5.804$  at 6 weeks and  $49.666 \pm 6.166$  at 12 weeks in subject practicing the bhastrika pranayama but this increase was insignificant with p value >.05.

Table 2: Effect of Bhastrika Pranayama on LF Component

LF	N	Mean	S.D.
BASAL	30	44.670	± 5.094
6 WEEK	30	43.730	± 4.857
12 WEEK	30	43.522	± 5.396

p value >.05, repeated measure ANOVA

Table 2 shows the effect of bhastrika pranayama on LF component of HRV over the time. HRV of the subjects shows a decrease in LF component from basal  $44.670 \pm 5.094$  to  $43.730 \pm 4.857$  at 6 weeks and  $43.522 \pm 5.396$  at 12 weeks. However, this decrease in LF component was found to be statistically insignificant with p value >.05.

Table 3: Effect of Bhastrika Pranayama On LF/HF Ratio

LF/HF	N	Mean	S.D.
BASAL	30	0.919	± 0.185
6 WEEK	30	0.893	± 0.174
12 WEEK	30	0.891	± 0.182

p value >.05, repeated measures ANOVA

Table 3 shows the effect of bhastrika pranayama on low frequency and high frequency ratio over the time. There was a decrease in LF/HF ratio from basal to 12 week with basal  $0.919 \pm 0.185$  to  $0.893 \pm 0.174$  at 6 week and  $0.891 \pm 0.182$  at 12 week. The decrease seen in LF/HF ratio was insignificant with p value >.05.

## DISCUSSION

During yoga practice there occurs fully relaxed body and mind that causes higher level of consciousness. In today's world of cut throat competition every single person particularly medical and paramedical students are striving hard to survive and it is taking its toll in the form of negative effects like anxiety, stress, mental tension and depression. Growing population and indiscriminate use of resources has led to polluted environment which further increases the negative effects. [8]

Pranayama, the fourth limb of yoga, in conjugation with other limbs of yoga plays a significant role in mental health issues like stress management, non-psychotic mood, generalized mood disorder and in case of depression. Pranayama by its beneficial cardio-respiratory effect helps in decreasing most of the negative effects. It is

a type of physiological stimuli that leads to adaptation of a positive behavior on regular practice. It helps in relaxing and calming the mind.<sup>[9]</sup>

Autonomic Function disturbance has a direct relation with cardiac activity. Higher the disturbance more is cardiac dysfunctioning and vice-versa. Autonomic Functions can be assessed by Frequency Domain Component of Heart Rate Variability.<sup>[10]</sup>

### High Frequency Component

In our study we observed an insignificant increase in HF component from basal value of  $49.384 \pm 5.503$  to  $49.648 \pm 5.804$  at 6 weeks and  $49.666 \pm 6.166$  at 12 weeks (Table 1).

Very few studies were available in the literature that shows the effect of bhastrika pranayama on HRV. Raghuraj et al observed a decrease in HF component after practicing bhastrika pranayama.<sup>[11]</sup> Decrease in HF component may be due to intense practice during bhastrika pranayama as compared to the anulom vilom pranayama. Parameters were recorded immediately after pranayama practice so sympathetic overflow is expected to be increased and thus parasympathetic discharge is expected to be decreased.

### Low Frequency Component

Results of our study showed an insignificant decrease in LF component from basal value of  $44.670 \pm 5.094$  to  $43.730 \pm 4.857$  at 6 weeks and  $43.524 \pm 5.396$  at 12 weeks (Table 2). This indicates an insignificant decrease in sympathetic drive.

Similarly Bal and Rajajeyakumar observed a significant decrease in sympathetic drive as indicated by decrease in DBP following regular practice of fast breathing pranayama.<sup>[12,13]</sup> However Raghuraj et al observed an increase in LF component of subjects practicing bhastrika pranayama.<sup>[11]</sup>

### Low Frequency/High Frequency Ratio

In our study there was an insignificant decrease in LF/HF ratio from

basal value of  $0.919 \pm 0.185$  to  $0.893 \pm 0.174$  at 6 weeks and  $0.891 \pm 0.182$  at 12 week; as shown in Table 3.

There is no other study which had seen the effect of bhastrika pranayama on LF/HF ratio except Raghuraj et al who observed a significant increase in LF/HF ratio after practicing bhastrika pranayama.<sup>[11]</sup>

## CONCLUSION

Although some researchers observed a significant decrease in sympathetic activity and increase in parasympathetic outflow, our study concludes a non significant increase in parasympathetic activity and an insignificant decrease in sympathetic activity following practice of fast breathing pranayama.

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