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ORIGINAL ARTICLE

EFFECTS OF PRACTICE OF PRANAYAMA ON CONTROL OF LIFE STYLE DISORDERS

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ABSTRACT: OBJECTIVE: There has been an increasing interest in Pranayama breathing exercises which have been known to improve the quality of life. Present study was conducted to find out the effect of Bhastrika and Anulom Vilom Pranayam and Yogasana on heart rate variability, general well-being, and cognition and anxiety level of the medical students. **METHODOLOGY:** 100 medical students were randomly divided into two groups. One group performed Bhastrika and Anulom Vilom Pranayam and the second Surayanamaskar for six weeks. The subjects were made to fill in PGI memory scale, Hamilton- anxiety scale and psychological general well-being schedule and record of the heart rate variability parameters was done, before and after six weeks of pranayam practice. **RESULTS:** The results showed highly significant increase in-high frequency (HF) components of heart rate variability and decrease in low frequency (LF) components and LF/ HF in the group practicing pranayam. There was also highly significant improvement of cognition, general well-being and anxiety as shown by the PGI memory scale, Hamilton-anxiety scale and psychological general well-being schedule score in this group. In yogasana group no significant changes were observed in the heart rate variability, cognition and anxiety although psychological general well-being schedule score significantly improved after six weeks of practice of yogasana. **CONCLUSION:** The study shows that practice of slow breathing type of pranayam for six weeks improves cognition, anxiety and general well-being and increases the parasympathetic activity. Whereas there was no effect of the yogasana on the above parameters except improvements in the general well-being.

KEYWORDS: Pranayama, Life style disorders.

INTRODUCTION: Yoga as an alternate medicine has gained tremendous importance during the past few years. It is a holistic way of living that has innumerable physical and mental benefits. However, it is still not clear as to how yogic practices bring about these benefits. We know that yogic exercises streamline the autonomic nervous system (ANS) and consequently improve not only cardiovascular and respiratory functions but also activity of other body systems thus giving a sense of well-being to the individual.[1, 2]

Pranayamic breathing exercises have been reported to affect the ANS in different ways depending on the breathing technique, duration of practice and the period of recording of the autonomic parameters.[3] Pranayamic breathing practiced exclusively via either nostril has opposite effects right nostril breathing increases sympathetic activity while left nostril decreases it.[4,5]

Alternate (A) nostril breathing (nadisuddhi) has been shown to decrease heart rate and blood pressure.[1] slow (S) breathing pranayam practiced for three months caused an increased parasympathetic activity and decreased sympathetic activity while fast breathing did not show any change in the autonomic functions.[6]

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Yoga mainly comprises practice of meditation, relaxation, control of breathing (asanas). In today's busy lifestyles due to time constraints one may not be able to perform all the same time. Also some forms of yoga can be a vigorous form of exercise and hence cannot be practiced by everyone. Therefore, to provide a tailor made yoga programme we should know the fitness benefits of various types of yogic practices so that they can be offered separately or in combination according to individual lifestyle and requirements.

While there have been many studies demonstrating the effects of some forms of pranayam and meditation on the ANS, there are no systematic studies to objectively assess the effects of various types of yogic practices on cognition and general well-being. Slow paced Bhastrika Pranayam practice has been shown to activate parasympathetics (OMIT S) system immediately after the practice. But, effects of short term practice of pranayam have not been studies.[6]

Therefore, the present study was undertaken to find out the effect of:

1. Short-term practice of Bhastrika and Anulom Vilom Pranayam on heart rate variability (HRV), cognition, anxiety and general well-being the subjects.
2. Practice of yogic asanas alone on the above parameters.
3. To see if the autonomic state depicted by HRB correlates with cognition, general well-being and anxiety scores of the subjects.

MATERIAL AND METHODS: The present study was conducted on 100 medical students in the age group of 18 to 22 years (mean age-19 years). Inclusion criteria from (correct) the study was that there should be no history of drug intake in any form, history medical or psychiatric illness and prior experience of yoga. Written informed consent was obtained from the students and the study was as per the guidelines laid by out institution's ethics committee. The students were subjected to PGI memory scale (PGIMS)+, Hamilton-anxiety scale (HAM-A)= and psychological general well-being index P (PGWB)[10] and basal record for HRV was done.

The subjects were randomly divided into two groups of 50 each. One group (the pranayam group) was taught Bhastrika and Anulom Vilom pranayam by a qualified teacher. In the morning from 6Am onwards, this group after mild warm up exercises for 10 minutes performed 3 sets of Bhastrika pranayam sitting in vajrasana with closed eyes.

A deep inhalation through nose followed by forceful exhalation through nose consisted of one breath and 20 such breaths at the rate of 12 to 15 per minute between each set when the subjects were asked to focus attention on breathing. After Bhastrika pranayam the subjects sat in sukhasana and concentrated on breathing for 5 minutes. They then performed 3 sets of Anulom Vilom pranayam sitting in sukhasana, each set consisted of 10 rounds.

Each round started with exhalation followed closure of the right nostril with the thumb of the right hand and inhaling slowly through the left nostril. After complete inhalation, the left nostril was closed with the little and ring finger of the right hand followed by opening the right nostril and exhaling slowly. The subject then inhales through the right nostril and exhales through left nostril.

This form one round of Anulom Vilom pranayam. There was an interval of 3 minutes in between each set of Anulom Vilom Pranayam, when subjects concentrated on breathing. After pranayam practice the group was made to lie down on their back for five minutes. This practice was done in empty stomach daily in the morning for 6 weeks.

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The control group after a mil (correct) warm up exercise for 10 minutes practiced Suryanamaskar taught by qualified yoga teacher. Twenty sets of Suryanamaskar were performed. After this the subjects were made to lie down their back for five minutes. This practice was done regularly for six weeks. Both control and study group practiced for about 40 minutes every day.

ECG recording was done, Calculations and analysis of the Heart Rate variability parameters were done the results were statistically analyzed by applying 'z' stats, 't' test and calculating person's correlation coefficient.

OBSERVATIONS: Four out of one hundred enrolled students were dropped from the study as they could not attend the regular practice sessions. Rest of the subjects participated in the study regularly.

The Pranayam Group: The score PGIMS which tests the cognition of the individuals increased from 76.93±4.38 to 91.88±3.89 ($p<0.001$) as shown in table 1. It was observed that the subjects who had lower initial scores had greater improvement in the scores after the practice. Similarly there was highly significant increase in the PGWB score from 86.78±5.78 to 96.44±2.97 ($p<0.001$) and decrease in HAM-A score from 49.26±5.44 to 31.60±2.57 ($p<0.001$) indicating highly significant decrease in anxiety in the students.

Highly significant increase in HF component of the HRV was also seen. HF component increased from 49.26±5.44 (normalized units) to 64.60±2.57 (normalized units) ($p<0.001$) in this group, along with a decrease in the LF components from 76.93±4.38 to 50.88±5.89 ($p<0.001$). In addition, the LF power/ HF power % decreased after the practice of pranayam from 4.67±2.08 to 1.58±0.75 ($p<0.001$) (table 2). This suggests an increase in parasympathetic tone to the heart.[11]

Group	PGIMS		HAM-A		PGWB	
	Basal	Post	Basal	Post	Basal	Post
Pranayam (n=50; male=30, female=20)	77.93±4.38	92.88±3.89***	50.26±5.44	32.60±2.57	87.78±5.78	98.44±2.97****
Yogasana (n=50; male=38, female=12)	79.90±4.70	81.24±2.30	56.67±6.56	45.53±4.48	90.16±8.40±8.40	97.86±3.23*

Table 1: Showing Scores of Psychological Scales

Values are mean ±SD, ***p-value <0.001, *p-value<0.01 as compared to the basal values. PGIMS: PGI memory scale, HAM-A: Hamilton rating scale for anxiety PGWB: Psychological general well- being scale

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Group	LF (nu)		HF (nu)		LF/HF (power %)	
	Basal	Post	Basal	Post	Basal	Post
Pranayam (n=50; male=30, female=20)	77.93±4.38	50.88±5.89***	49.26±5.44	64.60±2.57***	4.67±2.08	1.58±0.75**
Yogasana (n=50; male=38, female=12)	79.90±4.70	76.24±2.30	44.67±6.56	43.53±4.48	3.19±2.40	3.47±3.23

Table 2: Showing Heart Rate Variability Parameters

Values are mean ±SD; basal values are before the practice of pranayam and post values are after the practice of pranayam/ yogasana for six weeks, ***p-value<0.001 as compared to the basal values; LF- Low frequency components; HF: high frequency components, nu: normalized units.

The Yoga asana (control) Group: This group has almost the same basal scored of PGIMS. PGWB and HAM-A, but in this group there was no significant improvement seen in PGIMSI and HAM-A score. However there was a significant improvement seen in the PGWB score from 89.16±8.40 to 94.86±3.23 ($p<0.05$). LF, HF and LF/HF power % did not show any significant change in this group as compared to the basal data (table 2). This indicates that the autonomic tone in this group was not significantly affected.

In the pranayam group, there were changes in LF and HF components due to increase in parasympathetic tone in these subjects while in yogasana group the autonomic tone was not affected as reflected by the HRV parameters.

Pearson's correlation was calculated to find out the correlation between LF/HF power % with the PGIMS PGWB and HAM-A score both before and after the study in both the groups. There was positive correlation between LF/HF power % and PGIMS ($r=0.98$, $p\leq0.01$) and PGWB score ($r=0.98$, $p=<0.01$) in both the groups before and after the study which shows that these parameters improved with an increase in vagal parasympathetic tone. Similarly a negative correlation existed between the LF/HF power% and HAM-A score ($r=0.95$, $p=<0.05$).

DISCUSSION: ANS exerts control over functioning of most organs and tissues of the body. It optimizes internal environment along with the neuron-endocrine system. In this study a combination of slow breathing type of Bhastrika and Anulom Vilom pranayam practiced over a period of six weeks showed an increase in the vagal parasympathetic tone of the subjects as depicted by decrease in Lf, increase HF components and a decrease in the ratio of LF/HF (power%).[11,12] Pal et al[6] have reported similar findings of an increase in the vagal tone after practice of slow breathing exercise.

It is precisely not know how breathing exercises affect the ANS. Based on the present day knowledge one can speculate that afferent fibres in vagus nerve may be mediating some of the effects of breathing exercises by virtue of its connections with the regions of the brain controlling ANS, emotions memory and social behavior of the individual[13] inspiration stimulates stretch receptors in lungs; the impulses generated in these receptors are carried by vagal type C sensory fibres via nucleus of tractus solitarius to hypothalamus, which is the region controlling lower autonomic centre in the brainstem and spinal cord.[14]

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It is not known how these vagal sensory fibres alter the autonomic balance. It is probably different 'patterns' of impulses generated in the vagus during various breathing exercises that effects hypothalamus and alters autonomic balance. In addition, vagal sensory fibres directly inhibit sympathetic, vasomotor area in the medulla causing vasodilation and decrease in blood pressure when lungs are inflated[14].

Possible, there is also irradiation of impulses from vagal afferent fibres to other brainstem and medullary uncial that influence the vagal output to heart and other autonomic activity. In addition impulses from corticospinomic tracts that control respiration voluntarily, affect autonomic centers in the hypothalamus via connections through reticular activating system.[13]

These neural circuits may be involved in bringing about a decrease in sympathetic and an increase of parasympathetic tone.

Some workers[6,15] have also suggested that improvements in the ANS could be due to increased oxygenation of the tissues during the slow breathing exercises, as this decrease is not seen following fast type of breathing exercises. Possible different influences on the ANS, of different type of breathing exercises, may also be due to varying pattern of impulse traffic in the vagal sensory fibres All these are speculations and studies re required to know for sure how the ANS in affected by pranayamic breathing and why it is not affected by the yogic exercises.

The decrease in anxiety level seen in the pranayam group correlated positively with increase in the parasympathetic output to the heart. Also the improvement seen in short-term memory, numeric recall and visual recall, as indicated by increase in PGIMS scores, had a perfect correlation with increase in the parasympathetic tone to the heart. Most likely there is global increase in parasympathetic and decrease in sympathetic output which causes decrease in anxiety, improvement in cognition had general well-being of the subjects[16]. Decrease in anxiety was seen in the yoga asana group but it was not significant.

The improvement of general well-being scores seen in the pranayam group may be mediated by vagus as vagal afferents influence the limbic system and forebrain areas which are regions involved with generation of emotions and memory. Social behavior of the individual, which has been linked to ANS, also improves with increase in vagal tone. There is also dampening of hypothalamic-pituitary-adrenal axis by the vagal efferents which modulate the hormonal milieu and visceral state of the individual.

Central opioid system may also be involved in producing the changes seen in PGWB and HAM-A scores in pranayam group, although it is not known if pranaymaic exercises stimulates the central opioid system as there is no study investigating the role of central opioid system in producing the beneficial effects of pranayama. It can be deduced that the vagus plays an important role in determining the physiological state of the individual affecting emotions, thoughts, and attitude of the individual and its reactivity to the external environmental stimuli.[16]

Although there are afferents from other regions of the brain, which converge on the hypothalamus, limbic system and forebrain areas and influence the psycho-physiological state of the individual. We can voluntarily control the vagal afferent impulses from stretch receptors and thus are able to influence these important centres, which determine the internal environment and out response the external environment. The subjects in the yoga asana group showed significant improvement of PGWB scores. Yoga asanas are essentially a physical form of excise varying in severity from moderate to severe depending on the asana practiced.

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The improvement in PGWB scores seen in this group may be due to stimulation of central opioid system caused by increased activity in the sensory afferent fibres innervating proprioceptors in the joints and mechanoceptors in the exercising skeletal muscles.[17] This causes release of endorphins which are known to produce a feeling of euphoria. No significant effect was seen on cognition, anxiety and ANS in this group.

We can thus conclude that practice of slow breathing type of pranayam for six weeks increases parasympathetic activity, decreases anxiety levels, improves cognition and instills a sense of general well-being in the individual. In this study the yogasana was of benefit in improving PGWB score of the individuals, but had no significant effect on other parameters. It would be realistic to say that practice of pranayam can be used in treating patients suffering from anxiety, mood disorders, abnormal social interactions and some forms of autism.

Summary and Conclusion: The study shows that practice of slow breathing type of pranayam for six weeks improves cognition, anxiety and general well-being and increases the parasympathetic activity. Whereas there was no effect of the yogasana on the above parameters except improvements in the general well-being. There are very few studies on pranayam. Therefore much more research is needed in this field. We need more studies to elucidate the effects of different forms of pranayam and the way in which these breathing exercises affect out physiology. Studies are also needed to discern the role of central opioid system in producing the benefits of pranayam.

It was difficult to keep a large group of students in the study for six weeks and constant effort was required to motivate them. Another limitation was paucity of studies in the field of pranayam

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