

Original article:

Effect of pranayama on cardio- respiratory efficiency

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ABSTRACT:

Yoga is the science practiced in India since ancient times. It is derived from Sanskrit word Yuj means to bind together. Pranayama , a stage of yoga practice, is an ancient science which makes use of voluntary regulation of breathing and calm the mind. The present study was carried out in 60 healthy first year M.B.B.S. students (40 males & 20 females). These students were given Pranayama practice for one hour daily – 6 days in a week for two months. The subjects were assessed for various cardio respiratory parameters like respiratory rate (RR), FVC, FEV₁ PEFR, MVV, pulse rate (PR), blood pressure before and after Pranayama practice. Statistical analysis was done by paired T test. There was significant decrease in RR while FVC, FEV₁ PEFR, MVV were significantly increased in subjects after the practice of pranayama. There was highly significant increase in 40 mmHg endurance time and significant decrease in pulse rate.

Key words: Pranayama, FVC, PEFR

INTRODUCTION:

Yoga is the science practiced in India since ancient times. Modern medical science tries to achieve optimum physical & mental health of the individual through preventive, curative & promotive approach. In yogic practices the stress is mainly on promotive aspect although some yogic methods are prescribed for curative purpose also. Patanjali, the father of yoga, has suggested eight stages of yoga to secure health of body, mind & soul which are known as “Ashtang Yoga”. From medical point of view out of above eight stages, Asana & Pranayama are more important. Pranayama is an ancient science, which makes use of voluntary regulation of breathing and calm the mind. The word pranayama is formed by two words that are Prana & Ayama. Prana means an inner life force which provides energy to different organs & controls vital life processes. Ayama means voluntary effort to control & direct the Prana. Numerous people all over the world have derived subjective benefits by practicing pranayama regularly. But to prove its efficacy as a health science it must be studied in the light of modern medicine. Hence, present study was undertaken to find out effects of pranayama on cardio-respiratory efficiency. In the light of the above this study was undertaken to study the effect of pranayama on cardio respiratory functions.

MATERIAL & METHODS:

The present study was conducted on 60 healthy 1st year M.B.B.S. student of Dr. V. M. Govt. Medical College, Solapur. They underwent two months practice of pranayama under experts observation. They were studied for different cardiovascular & respiratory parameters before & after the pranayama practice. The subjects did not undertake any other physical exercise while the present study was being conducted. No subject had been performing any yoga practice before. After 2 months all the following cardio-respiratory parameters were recorded again & results were compared using paired ‘t’ test. Resp. rate, Pulse rate, BP, FVC, FEV₁, PEFR, MVV, Breath holding time (BHT), 40 mm Hg endurance test, Harvard fatigue index. (HFI) Lung function tests were carried by Medspiror (Med system Pvt. Ltd. Chandigarh).

Following Pranayama practices were performed daily by the subject for 2 months.

1. Prayer : 5 Mins
2. Omkar recitation : 5 Mins
3. Kapalbhathi : 10 Mins
4. Yogic Shwasan : 10 Mins
5. Bhastrika : 10 Mins
6. Naddishuddh : 10 Mins
7. Bhramari : 10 Mins

Observations & Results: The results are presented in Tables 1 & 2 Showing mean value & standard deviation of cardio-respiratory parameters.

Table 1: There was highly significant decrease in RR while highly significant increase in BHT, FVC, FEV₁, PEF_R, MVV.

Sr. No.	Parameter	Before Pranayama Practice	After Pranayama Practice	P. Value
		Mean ± S. D.	Mean ± S. D.	
1	Respiratory Rate (per min)	19.26 ± 3.56	12.61 ± 3.05	P<0.001
2	BHT After Max Inspiration (Second)	39.45± 12.67	52.63 ± 11.1	P<0.001
3	BHT After Max Expiration (Second)	27.47± 9.37	37.24± 11.68	P<0.001
4	FVC (L)	1.86 ± 0.70	2.38 ± 0.72	P<0.001
5	FEV ₁ (L)	1.82 ± 0.65	2.34 ± 0.65	P<0.001
6	PEFR (L/sec)	5.98 ± 1.84	7.18 ± 2.21	P<0.001
7	MVV (L/min)	114.45±27.08	123.10±27.12	P<0.001

Table 2: There was highly significant increase in 40 mmHg endurance time and significant decrease in pulse rate. No significant change in blood pressure & HFI.

S.N.	Parameter	BeforePranayama	After Pranayama	P. Value
1	40 mmHg Endurance time (Sec)	34.24 ± 10.87	42.63 ± 13.32	P<0.001
2	Pulse rate (per min)	71.79± 6.07	69.08 ± 6.16	P<0.001
3	Systolic B.P. (mmHg)	117.58± 8.81	116.19± 7.85	P>0.001
4	Diastolic B.P. (mmHg)	77.42 ± 5.41	76.06 ± 4.95	P>0.001
5	HFI	77.18 ± 13.40	77.42 ± 13.23	P>0.001

DISCUSSION:

In the present study, there was a significant decrease in rate of respiration. Usually breathing is not a conscious event & is regulated automatically by bulbopontine respiratory neuronal complex, which is further modified by suprapontine mechanisms in the conscious being. The pneumotaxic centre is supposed to relay suprapontine messages which promote voluntary inspiration & expiration^(18,19). During daily practice of pranayamic breathing the basic activity of bulbopontine complex, is modified in such a way that it slows down its rhythm voluntarily prolonging the phase of inspiration & expiration to their maximum extent. Thus it makes the lungs to work to their maximum extent to take O₂ & expire Co₂ maximally leading to decrease in RR⁽¹⁹⁾. Thus by practicing pranayama for few wks, the bulbopontine complex is adjusted to a new pattern of breathing which is slower than its basal rhythm. There was highly significant increase in FVC, FEVI, MVV & PEFV after pranayama practice. This increase can be explained on the following basis.

Due to practice of pranayama there occurs :

- a) Strengthening of muscles of respiration . Increased range of movement of diaphragm & Emptying & filling of respiratory apparatus is more efficient & complete⁽¹²⁾.
- b) Lung inflation near to total lung capacity is a major physiological stimulus for the release of surfactant into alveolar space which increases lung compliance.^(12, 20)
- c) In addition it is suggested that lung inflation near to total lung capacity is a physiological stimulus for the release of prostaglandins which decreases bronchial smooth muscle tone, which in turn decreases airway resistant with a subsequent increase in MVV & FEV₁⁽¹⁹⁾.

The other possible mechanism for improved PFT may be :

1. Pranayama practice increases compliance of thorax by increasing mobility of chest.
2. It also helps in removal of secretions from respiratory passage making easy entry of more air in alveoli.

There was highly significant increase in breath holding time both after maximum inspiration & maximum expiration & highly significant increase in 40 mmHg endurance time. This may be due to^(9, 12, 19) –

1. Decreased responsiveness of respiratory centers to Co₂.
2. Decrease in basal metabolic rate of body characterized by decreased Co₂ production & decreased O₂ consumption.

Thus allowing breath holding for a longer time.

3. In addition, due to regular practice of pranayama, muscle endurance is increased & it delays the onset of fatigue, thus allowing the breath holding for longer time.

In the present study, resting pulse rate decreased significantly. This decrease may be due to^(2,17,20) –

1. Increased vagal tone
2. Decreased sympathetic discharge.
3. Decreased release of catecholamines in blood.
4. Decreased BMR & O₂ consumption, thus decreasing work load on the heart.
5. Decreased sympathetic discharge to skeletal muscle vasculature which allows significant vasodilation to improve peripheral circulation.
6. Calming effect of pranayama.

In our study, there was decrease in systolic & diastolic blood pressure but the decrease was not statically significant & no significant changes in HFT. It may be that practicing pranayama along with different yogasana & meditation for longer duration was responsible for decrease in blood pressure observed by other workers^(11, 16). But as our study was of

shorter duration & pranayama was not associated with mediation & yoga training we did not observe significant decrease in blood pressure & significant increase in HFI.

Conclusion:

From present study it can be concluded that regular practice of pranayama mainly improves respiratory efficiency as seen by highly significant in respiratory parameters. It also improves cardiac efficiency as indicated by significant decrease in pulse rate & highly significant increase in 40 mmHg endurance time. This increase in cardio respiratory efficiency is result of multiple factors. regularly and is associated with yogasans & mediation, the cardiac efficiency can be improved to a greater extent. By extending these results it can be suggested that pranayama practice may be applied as an adjunct to conventional therapy in diseases like bronchial asthma, chronic bronchitis, COPD.

References:

1. Anand B.K. Yoga and Medical Science. IJPP – 1991, 35(2): 84-8
2. A.A.Khanam et.al. Study of pulmonary & autonomic functions of asthma patients after yoga training. IJPP – 1996: vol-40(4):318-324.
3. A. Stancak JR & M. Kuna et.al.Observations on respiratory and cardiovascular rhythmicities yogic high frequency respiration *physiol Res.*40, 1991:345-355
4. A. Stancak JR & M. Kuna M. Srinivasan. Kapalhati - Yogic cleansing exercise and cardiovascular and respiratory. *Homeost Health Dis.*1991 33(3) 126-134.
5. Bhanu Prakash Joshi. Effect of some yogic practice on Human subject physiological & Psychological Physiological and psychological effects of Yoga – 2003 1-3
6. Belman MJ, Gasser GA. Ventilatory muscle training in the elderly , *J.Appl. Physiol.* 1998 64(3) 899- 905.
7. David S. and Brian Kennedy.The effects of unilateral forced nostril breathing on the heart *International J. of neuroscience.*1993, vol. 7, 47-60.
8. Gopal K.S. and V. Anantbraman, O.P. Bhatnagar, The effect of yogasanas on muscular tone and cardio-respiratory adjustments. *Yoga Life* 1975. 6(5), 3-11.
9. H.S.Nayar, R.M.Mathur. Effects of Yogic exercises on Human physical efficiency. *Indian J.Med.Res.* 63, 1975, 1369-1376.
10. K.N.Udupa , The scientific Basis of Yoga. *JAMA*-June 1972, vol. 220(10).
11. K.S.Gopal , Effect of Yogasanas and Pranayamas on Blood pressure, Pulse rate and some respiratory function. *IJPP*- July-1973, vol 73(3), 273-276.
12. K. Makwana, Effect of short term yoga practice on ventilatory function tests *IJPP*-July -1988, vol 32(3), 202
13. K.N. Udupa, Studies of the effect of some yogic breathing exercises (Pranayamas) in normal persons, *I.J. of medical research*- 1975, 1062-1065.
14. S.K.Ganguly & M.L. Gharote, Cardiovascular efficiency before and after yogic training. ‘Yoga Mimans’ 1974, Vol 17, 89 – 97.
15. H.R. Nagendra; et.al., Pranayama – The art and science,2003 – 2nd edition.
16. Jyotsana R. Bharashankar , Effect of yoga on cardiovascular system in subjects above 40 .Yrs. *IJPP*, 2003, 47(2), 202 – 206.
17. S. Telles et.al. Physiological changes in sports teachers following three Months of training in Yoga. *Indian journal of medical sciences*, Oct 1993, vol.47, 235-238
18. Samson Wright , 1982, 15th edition 167-169.

19. L.N. Joshi , Effect of short term pranayama practice on breathing rate and Ventilatory functions of lung. IJPP – 1992, 35(2), 105-108.
20. Rajkumar Yadav and Shobha Das: Effect of Yogic practices On pulmanory functions in young females, IJPP – 2001, 45(4), 493-496.

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