Original Research Article

Effect of yoga training on autonomic and lung function tests in normal young volunteers

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Abstract
The term yoga comes from "Yuj" meaning to join, to bind, to assosciate with and so forth. Yoga and meditation have been studied all over the world to explore the possibility of it being used therapeutically and also research on higher dimensions. This study was conducted to assess the changes in autonomic and lung functions in young male student volunteers. Twenty six students in each group. Group I subjects were given yoga training for a duration of 8 weeks. Group II subjects served as control. Autonomic function tests involving Valsalva maneuver and deep breathing and pulmonary function tests viz. FEV_1, FVC, PEFR, MVV, TLC and respiratory pressure measurements were performed before the start of the study. The recordings were also done 8 weeks later. Yoga training produced highly significant increase in VR, PEFR, MVV, MEP and MIP. FEV_1 and FVC also increased significantly after yoga training. But these values showed negligible change in the control group. Increase in FEV_1, FVC, PEFR was statistically significant. The increase in MIP and MEP was highly significant. The present study, in conclusion shows that yoga training for eight weeks improves the autonomic and lung functions.

Keywords: Yoga, therapeutically, sages.

Introduction
Yoga is a system of physical, mental and spiritual discipline developed by the sages of India and has been practiced down the ages. Yoga requires tremendous effort, perseverance and patience. According to hathapradhipika (II- 78) – slimness of body, clarity of voice, brightness of eyes, freedom from diseases, control over sex, stimulation of gastric fire and purification of "nadis" are characteristics of success in yoga. Recently yoga has been recognized world-wide as a treatment procedure for many of psychosomatic diseases which are the sequelae of stress and strain of the present times.

Yoga is grounded in cultural and religious milieu which speaks of the heritage of India. It involves not only postures, breathing exercises, or meditation but also following yogic diet, faith and a way of spiritual living. Since yogic practices result in an in the equilibrium functioning of the sympathetic and parasympathetic components of the autonomic nervous system[1] (Anand 1961) it is being tried in the treatment of illnesses which are the resultant of stress on that system example psychosomatic diseases. Human parasympathetic cardiovascular control may have great importance, because parasympathetic reflex mechanisms are involved in diseases of major public health significance for which animal models may be imperfect or non existent[2]

The scientific basis of yoga has been addressed by Udupa and Singh[3](1975). Modern medical science which employs methods like progressive relaxation, autogenic training and reciprocal inhibition as behavioral treatment modalities in psychiatric practice have been shown to be similar to shavasana, pranayama and samyama meditation [4] (Varma 1996).

Yoga has the advantage of being inexpensive, easily accessible, devoid of side effects and it is also grounded in our cultural-religious milieu.

Materials and Methods
The study was conducted on 26 male medical student volunteers. The study protocol was explained to the student volunteers and written consent was obtained from them. A routine medical examination was done before the study was started. The subjects were highly co-operative during the entire study period. Random assignments of the subjects was carried out to group them into two groups. Group I subjects underwent yoga training and Group II subjects served as control. The control group received no yoga training. The study was approved by the institute ethics committee.

The subjects age ranged from 17-18 years, weight 44-75 Kg (mean = 56) and height 146-173 cm (mean ± SE= 168.5 ± 1.17). The subjects were advised to take non-spicy foods, refrain from smoking and drinking alcohol. They were also instructed not to practice any other type of muscular exercise or meditation for that period of 8 weeks. The group II were also given the same instructions except that they did not do yoga.

The entire group I subjects received the same yoga training. Yoga practice sessions were held for 60 min daily under the expert guidance and supervision of an experienced yoga teacher. The list of items and duration of each yogic practice session is given in Table 1. This schedule was followed throughout the training period of 8 weeks. The detailed description of yogic techniques are given in standard works on yoga by Yogeshwar and in the book published from Vivekananda Kendra, Madras.

The autonomic and pulmonary function tests were done prior to yoga training and at the end of training period. Both these tests were non-invasive. The subjects were instructed not to drink coffee, tea, cola or smoke tobacco 12 hours before the measurements. All the measurements were performed between 11 a.m. and 1 p.m. to minimize any diurnal variation in cardiovascular system regulation. All parameters were recorded 2 hours after breakfast and ½ hour before lunch to avoid the effect of food intake on these recordings.

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The temperature in the recording room was maintained between 26-28•C.

Autonomic Function Tests

The status of autonomic functions was assessed by employing Valsalva maneuver and deep breathing test[5](Bannister, 1993).

Valsalva Maneuvre

The subject remains seated throughout the test. The subject is asked to blow against a pressure of 40 mmHg (5.3 kPa) by expiring forcefully through a mouth piece attached to a manometer and maintaining this level for 15 seconds (s). Heart responses were recorded before, during and 30 s following the maneuver. The test was carried out 3 times and between each test rest of 1 minute was provided.

The valsalva maneuver consist of forced expiration against resistance. In this maneuver the normal circulatory responses occur, provided this is maintained for at least seven seconds[5](Bannister 1983). After the onset of straining, an initial blood pressure increase occurs for 2-3 seconds (Phase I), followed by a progressively decreasing blood pressure and diminution of pulse pressure during continued strain and partial recovery of blood pressure in the later part of the strain (Phase II). After release of strain there is initial further fall in blood pressure for a few seconds (Phase III), followed by a rebound hypertension (Phase IV). The heart rate changes are secondary events triggered by blood pressure responses. There is slowing of heart rate with onset of straining (Phase I), increase in rate during straining (Phase II) and immediately after straining (Phase III) and a marked slowing of rate following Phase III (Phase IV).

Deep Breathing Test

To perform this test subjects were allowed to remain in sitting position till their heart rate stabilized, following which they were asked to breathe deeply, steadily and slowly for one min. at a rate of 6 breaths/min. the respiratory sinus arrhythmia which occurs during this test was recorded continuously along with the stethographic record. The parasympathetic reactivity was calculated by E/I ratio and deep breathing difference (DBD).

These tests are the standard tests that are being administered to assess the autonomic functioning throughout the world[6,7,8](iain, 1986; chu 1989,zieglar,1992). the electrocardiographic and stethographic record of respiration were obtained on two channels of a polygraph (Grass Inst. Co., Quicy, USA., model 7). The ECG in standard limb lead II was recorded for all the tests. For recording the respiratory phases, a stethograph was secured around chest and pressure changes were sensed by a volume transducer (PT5A, Gross Inst. Co. USA). The baseline cardiorespiratory parameters were recorded before each test.

The following autonomic function tests were carried out:

1. Valsalva ratio (VR)

VR was calculated as the ratio of longest R-R interval shortly after the strain to the shortest interval during the strain. Highest VR of the three maneuvres was used for statistical analysis.

2. Bradycardia ratio (BR)

BR was calculated as the ratio of the longest R-R interval during phase IV to the mean R-R interval during the period between 30-15 seconds before the strain.

3. Tachycardia ratio (TR)

TR was calculated as the ratio of shortest R-R interval during the strain to mean R-R interval as mentioned with BR.

4. E/I ratio

$$\text{E/I ratio} = \frac{\text{Maximum R-R interval during expiration}}{\text{Minimum R-R interval during inspiration}}$$

5. Deep breathing difference (DBD)

The difference that exists in maximum and the minimum heart rates seen in each respiratory cycle was calculated and the result was expressed as the mean differences of six successive cycles.

Pulmonary Function Tests

Pulmonary function testing was done by computerized pulmonary function testing system. The software used for this testing was Flexiflo lung function system Version 3.0 from P. K. Morgan Inst. Inc., Andover, MA., USA. The measurements were taken in the sitting posture. The neck was not flexed or extended too much. The subjects were asked to take a deep inspiration (to total lung capacity) and blow into the spirometer as forcefully and as completely as possible. Practice trials were administered until we were satisfied that the subjects understood and performed the task as required of them. Tests were repeated with an interval of 2 minutes between them and the best of 3 similar observations was taken for statistical analysis. The parameters that were taken for this study are the following. 1. FEV_1, 2. FVC, 3.PEFR, 4.MVV, 5.TLC.

Maximal expiratory pressure (MEP) was determined by asking the subjects to blow against a mercury column after taking in a full breath (i.e. Total lung capacity) and to maintain the column at the maximum level for about 2 seconds. Maximal inspiratory pressure (MIP) was determined by asking the subjects to perform maximal inspiratory effort against the mercury column after breathing out fully (i.e. to residual volume). The MEP and MIP were measured with the subject in the sitting position.

Satistical Analysis

Students' paired 't' test was used in both the groups. Statistical significance was considered when p value was <0.05.

Results

The results are given in tables 2-5. The values are presented as mean ± S.D. in figures.

I. Autonomic function tests

1. Valsalva ratio: VR in group I subjects (study group) was found to be 1.80 before and 2.13 after the yoga training respectively. This difference was statistically insignificant (p<0.001). In group II subjects (control group) it was found to be 1.915 initially and 1.948 at the end of the study and this difference was statistically not significant.
2. Bradycardia ratio: BR was 1.322 and 1.375 in group I and 1.377 and 1.368 in group II subjects before and after the study respecteively. These changes were not significant statistically.
3. Tachycardia ratio: TR in group I subjects was found to be 0.700 and 0.638 and in group II it was 0.744 and 0.735 before and after the study. In both the groups the changes were not significant.
4. E/I ratio: In group I it was 1.537 and 1.514 while in group II it was 1.549 and 1.532 before and after the study. The changes in both the groups were statistically not significant.
5. DBD: It was found to be 38.3 and 43.0 in group I subjects whereas it was 40.31 and 42.69 in group II subjects before and after the study. The change in DBD observed in both the groups was not significant

II. Pulmonary function tests (table no. 4&5, fig 5-10)

1. FEV_1 (in liters): FEV_1 in group I subjects was found to be 3.06 before and 3.55 after yoga training. This difference was statistically significant (p<0.01). In group II subjects (control group) it was found to be 3.006 initially and 3.089 at the end of the study and this difference was statistically not significant.
2. FVC (in liters): FVC was 3.455 and 3.886 in group I (change was significant, p<0.05) and 3.346 & 3.421 in group II (not significant) before and after the study.
3. PEFR (in liters /min): In group I subjects it increased significantly (p<0.01) from 435.6, before the study to 483.76, after the study and in group II it changed from 410.83 to 416.38 and the change was not significant.
4. MVV (in liters): In group I it was 137.0 and 155.3 while in group II it was 134.54 and 125.15 before and after the study. The changes in these values were statistically significant (p<0.001) in group I while it was insignificant in group II.
5. TLC (in liters): It was found to be 4.25 and 4.92 in group I where as it was 4.45 and 4.20 in group II before and after the

study. This showed that the change was not significant in both the groups.

6. MEP (in mmHg): This was found to be 60.5 before and 83.4 after the training in group I subjects and the change was highly significant (p<0.001). In group II it was initially 66.36 and changed to 69.00 and this change was not significant.

7. MIP (in mmHg): In group I subjects it was 53.15 before and 76.46 after the study and the change was highly significant (p<0.001). The group II had respective values of 56.27 and 59.45 and the change was not significant.

Table 1: Sequence and duration of practice of yoga techniques by group I subjects

Sl. No.	Yoga technique	Duration	
		Min	Sec
1.	Meditation in padmasaasan	5	-
2.	Much-bhastrika in vajraasan (6 rounds)	1	30
3.	Bandh-traya	-	20
4.	Agnisar	-	20
5.	Taalasan	-	20
6.	Trikonaasan	1	-
7.	Bakaasan	-	20
8.	Halaasan	-	20
9.	Sarvaangaasan	-	20
10.	Matsyaasan	-	20
11.	Paschimottaanaasan	-	20
12.	Bhujangaasan	-	20
13.	Shalabaasan	-	20
14.	Naukaasan	-	20
15.	Naavaasan	-	20
16.	Ardh-matsyendraasan	1	-
17.	Shirshaasan	-	20
18.	Shavaasan	10	-

Table 2 :Valsalva ratio (VR), bradycardia ratio (BR), tachycardia ratio (TR), Expiration / Inspiration ratio (E/I ratio) and deep breathing difference (DBD) before and 8 weeks after yoga training in group I (trained) subjects.

Subject	VR		BR		TR		E/I Ratio		DBD	
	Before	After	Before	After	Before	After	Before	After	Before	After
1.	2.17	2.70	2.08	1.68	0.95	0.62	1.69	1.33	42	49
2.	1.95	2.10	1.23	1.31	0.63	0.63	1.53	1.70	37	53
3.	2.38	2.61	1.38	1.25	0.58	0.55	1.57	1.60	39	45
4.	1.62	2.01	1.13	1.46	0.70	0.70	1.48	1.60	42	49
5.	1.64	1.70	1.24	1.16	0.76	0.67	1.60	1.58	45	42
6.	1.65	2.10	1.31	1.45	0.79	0.67	1.44	1.29	37	25
7.	2.00	2.22	1.10	1.25	0.55	0.56	1.44	1.42	34	34
8.	1.39	1.95	1.18	1.24	0.85	0.63	1.25	1.52	25	41
9.	1.84	2.47	1.35	1.23	0.74	0.50	1.57	1.64	39	53
10.	1.65	1.85	1.31	1.30	0.79	0.70	1.40	1.50	34	42
11.	1.85	1.90	1.20	1.25	0.65	0.66	1.62	1.56	39	43
12.	2.52	2.36	1.40	1.95	0.55	0.83	1.93	1.29	46	32
13.	2.05	2.47	1.28	1.35	0.62	0.55	1.46	1.65	39	51
Mean	1.80	2.13	1.32	1.37	0.70	0.63	1.53	1.51	38.3	43
SD	0.23	0.30	0.245	0.22	0.122	0.086	0.163	0.139	5.41	8.52
SE	0.069	0.09	0.068	0.061	0.03	0.024	0.045	0.039	1.499	2.36
't'	5.44		0.833		0.05		1.81		0.345	
p	0.001		Not Significant		Not Significant		Not Significant		Not Significant	

Table 3 : Valsalva ratio (VR), bradycardia ratio (BR), tachycardia ratio (TR), Expiration / Inspiration ratio (E/I ratio) and deep breathing difference (DBD) initially (I) and 8 weeks after (A) in group II (control) subjects.

Subject	VR		BR		TR		E/I Ratio		DBD	
	Before	After	Before	After	Before	After	Before	After	Before	After
1.	1.52	1.6	1.13	1.25	0.74	0.75	1.73	1.52	57	44
2.	1.92	2.04	1.33	1.27	0.69	0.62	1.48	1.42	39	37
3.	1.4	1.56	1.16	1.38	0.83	0.88	1.48	1.60	42	55
4.	2.0	2.0	1.19	1.09	0.59	0.55	1.6	1.71	49	60
5.	2.59	2.47	1.58	1.46	0.61	0.61	1.6	1.58	40	43
6.	1.77	1.84	1.5	1.45	0.85	0.83	1.65	1.62	51	49
7.	1.75	1.72	1.31	1.35	0.74	0.7	1.66	1.6	50	47

8.	3.1	3.12	1.72	1.68	0.64	0.64	1.76	1.7	44	49
9.	1.8	1.85	1.18	1.23	0.66	0.66	1.45	1.42	27	25
10.	1.86	1.9	1.27	1.24	0.68	0.68	1.7	1.7	41	46
11.	1.64	1.72	1.58	1.46	0.96	0.95	1.56	1.62	43	49
12.	2.13	2.1	1.76	1.72	0.83	0.84	1.27	1.23	24	32
13.	1.42	1.40	1.19	1.21	0.84	0.85	1.20	1.21	17	19
Mean	1.915	1.948	1.377	1.368	0.744	0.735	1.549	1.532	40.31	42.69
SD	0.476	0.445	0.222	0.184	0.111	0.124	0.170	0.168	11.46	11.63
SE	0.132	0.124	0.062	0.051	0.031	0.034	0.047	0.047	3.177	3.225
't'	1.628		0.31		0.92		0.73		0.340	
p	Not Significant		Not Significant		Not Significant		Not Significant		Not Significant	

Table 4 : Forced expiratory volume in first second (FEV_1), forced vital capacity (FVC), peak expiratory flow rate (PEFR), maximum voluntary ventilation (MVV), total lung capacity (TLC), maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) before and 8 weeks after yoga training in group I (trained) subjects.

Subject	FEV_1 (L/s)		FVC (L)		PEFR (L/min)		MVV (L/min)		TLC (L)		MIP (mmHg)		MEP (mmHg)	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
1.	3.0	3.3	3.1	3.5	512	556	149	160	4.2	4.2	40	80	64	98
2.	3.0	3.0	3.0	3.0	410	440	111	117	3.5	3.5	40	62	60	72
3.	3.7	4.2	4.2	4.4	435	508	134	134	5.4	5.4	40	64	60	78
4.	3.1	3.0	3.3	3.3	363	510	151	160	3.9	4.0	60	100	76	98
5.	3.5	3.5	3.9	3.8	416	463	159	167	4.2	4.6	42	60	73	90
6.	3.4	4.1	3.5	4.3	398	426	136	159	3.7	3.8	44	62	78	82
7.	4.1	5.1	4.7	5.9	500	465	124	183	6.3	7.9	70	98	82	88
8.	1.8	2.0	2.4	2.1	165	220	62	77	2.2	3.4	15	30	45	56
9.	2.8	3.3	3.0	3.9	591	641	157	180	4.4	4.5	70	86	64	82
10.	3.1	3.9	4.0	4.2	445	504	159	178	5.1	5.8	80	100	62	88
11.	3.2	3.6	3.5	3.6	424	530	141	151	4.1	5.9	60	84	43	68
12.	3.4	3.5	4.5	4.5	475	482	144	179	5.0	6.7	80	90	50	80
13.	1.8	3.7	1.9	3.8	529	544	154	174	3.2	4.3	50	78	60	74
Mean	3.06	3.55	3.455	3.886	435.6	483.7	137	155.3	4.25	4.92	53.15	76.45	60.5	83.4
SD	0.656	0.729	0.804	0.846	102.3	97	26.68	30.37	1.05	1.34	18.92	20.25	12.9	15.97
SE	0.14	0.15	0.15	0.16	28.37	26.9	7.40	8.42	0.29	0.37	5.25	5.61	3.58	4.43
't'	3.30		2.57		3.70		4.3259		1.235		9.34		4.43	
p	< 0.01		< 0.05		< 0.01		< 0.001		Not Significant		< 0.001		< 0.001	

Table 5 : Forced expiratory volume in first second (FEV_1), forced vital capacity (FVC), peak expiratory flow rate (PEFR), maximum voluntary ventilation (MVV), total lung capacity (TLC), maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) initially (I) and 8 weeks after (A) in group II (control) subjects

Subject	FEV_1 (L/s)		FVC (L)		PEFR (L/min)		MVV (L/min)		TLC (L)		MIP (mmHg)		MEP (mmHg)	
	I	A	I	A	I	A	I	A	I	A	I	A	I	A
1.	3.33	3.40	3.62	3.54	417	420	131	134	4.0	3.7	62	60	77	80
2.	2.63	2.66	2.64	2.66	447	457	138	134	4.5	3.7	48	50	52	70
3.	3.06	3.56	3.29	3.84	440	424	122	100	4.1	4.1	80	100	112	122
4.	2.76	2.83	3.49	3.50	414	418	157	148	4.5	4.5	60	60	80	66
5.	2.30	2.20	2.20	2.20	400	400	123	96	3.4	3.3	46	48	60	60
6.	2.77	2.81	3.56	3.64	385	400	141	138	7.5	5.6	50	54	40	38
7.	2.86	2.92	3.92	3.94	234	254	123	96	3.4	3.3	42	44	60	64
8.	3.66	3.76	4.25	4.38	478	497	108	113	4.9	4.9	44	48	65	69
9.	3.17	3.18	3.24	3.27	445	430	130	125	5.1	5.2	70	72	60	69
10.	2.77	2.79	2.77	2.80	343	354	119	131	4.9	5.0	56	59	60	66
11.	2.76	2.80	2.91	2.95	501	514	157	157	4.0	4.0	98	94	82	80
12.	3.12	3.16	3.18	3.20	434	445	169	134	3.5	3.6	30	32	50	54
13.	3.18	3.20	3.28	3.33	392	400	131	134	4.0	3.7	36	40	52	50
Mean	3.006	3.089	3.346	3.421	410.83	416.38	134.5	125.2	4.45	4.2	56.3	59.5	66.4	69
SD	0.302	0.347	0.463	0.495	68.70	64.43	17.47	19.4	1.07	0.76	20.31	21.49	20.21	21.55
SE	0.087	0.100	0.134	0.143	20.12	18.59	4.85	5.38	0.29	0.21	6.126	6.478	6.09	6.496
't'	1.806		1.637		1.92		2.054		1.599		1.768		1.086	
p	Not Significant		Not Significant		Not Significant		Not Significant		Not Significant		Not Significant		Not Significant	

Discussion

The Valsalva ratio (VR) in the control subjects in the present study was similar to that reported for Indian subjects[9]. In the present study it is observed that after yogic practice VR has significantly increased. As the magnitude of VR is mainly under parasympathetic control[10], the significant increase in VR in this study indicates an improved parasympathetic tone of the subjects after yoga practice in these subjects. Such increased vagal activity has decreased the heart rate which has caused prolongation of the R-R interval in phase IV of the Valsalva maneuver and thereby raising the VR. However, the role of sympathetic system in causing the increased VR cannot be ruled out.

In this study bradycarida ratio (BR) did not show any significant change after yoga training. BR is thought to be an index of Valsalva maneuver[11] as it bears a high degree of correlation (r=0.94) with VR[12]. However, Ewing et al[13] reported that some diabetics who showed no bradycardia after the Valsalva maneuver had normal VR. Piha[10] after an intensive study also had concluded that BR is not suitable in assessing the autonomic function in subjects beyond the age of 29 years.

The magnitude of tachycardia occurring during the Valsalva maneuver is dependent on vagal withdrawal and sympathetic stimulation. However it has been indicated that the sympathetic component of the autonomic nervous system plays an important role in producing the tachycardia during Valsalva maneuver[10]. The non significant change of tachycardia ratio in this study might be due to the sympathetic component being balanced by the increased vagal activity produced by the yoga training.

The sinus arrhythmia seen in deep breathing is due to neural activity, the efferent limb being vagal. The efferent sympathetic pathway is not involved in production of respiratory sinus arrhythmia. The afferent pathway in production of respiratory sinus arrhythmia is from the systemic arterial baroreceptors, the low pressure receptors in the heart and possibly the stretch receptors of the lung. The increase in heart rate is usually connected with inspiration and the decrease with expiration. The magnitude of respiratory sinus arrhythmia is maximal with breathing frequency of about 6 breaths per minute and this forms the basis of deep breathing test.

It is generally agreed that the heart rate response to deep breathing is mediated almost exclusively by parasympathetic activity[14].Piha et al[10]also made a similar observation that the deep breathing difference is vagally mediated. Ayesha et al[15] in their study observed that two weeks of yoga training did not produce any change in E/I ratio. In the present study it was observed that the E/I ratio has not achieved the statistical significance. Hence it is likely that a greater duration of training or a lager sample size may be required to produce a change in these two parameters.

In group I subjects yoga training produced a significant increase in FVC, FEV_1. The increase in PEFR, and MVV was statistically highly significant. All these values did not change in the control group. The improvement in FVC and PEFR in this study is consistent with that of Udupa et al[3]. Nayar et al[16] also reported that yoga training improves FVC and FEV1 significantly.

PEFR is the single most useful test for lung function and it is also a sensitive test[17]. Nagarathna and Nagendra[18] reported that yoga training produces a significant improvement in PEFR in bronchial asthma patients. Joshi et al[19] also have reported an increase in TLC after short term pranayama practice.

Maximum respiratory pressures are specific indices of respiratory muscle strength and their values can be altered in patients even when there is a little abnormality in other commonly used PEFR tests (Black & Hyatt)[20]. Since the highest MEP is obtained near TLC and the highest MIP near residual volume, we measured MEP after the subject took in a full breath, while MIP was measured after the subject breathed out fully. In the yoga group, MIP increased highly significantly while the MEP also showed a significant increase. Madanmohan et al[21] reported that yoga training increases MEP by 37% and MIP by 26%, these changes being statistically significant. The results in this study do not agree with those of Gopalet al[22] who have reported a lower MEP in yoga trained subjects as compared to untrained subjects. Increase in MIP and MEP suggests that yoga practice improves the strength of expiratory as well as inspiratory muscles. Yoga postures involve isometric contraction which is known to increase skeletal muscle strength.

Anand et al and Wenger et al[23] have reported that yogis can markedly increase their intrathoracic pressure by strong contraction of thoracic and abdominal muscles. Earlier studies have postulated that yoga breathing produces hypertrophy of respiratory muscles including the intercostals, abdominal muscles and diaphragm[19,24]. The yoga training results in an increase in the strength the endurance of the respiratory muscles. Thus the result of yoga training is an increase in the lung function tests done in our study viz., MEP, MIP, FVC, FEV_1, PEFR and MVV. Measurement of respiratory pressures which is a specific test for measuring respiratory muscle strength is easy to perform, reproducible and produces no complications[20,21].

Conclusion

Yoga training produced highly significant increase in VR, PEFR, MVV, MEP and MIP. FEV_1 and FVC also increased significantly after yoga training. Increase in FEV_1, FVC, PEFR was statistically significant. The increase in MIP and MEP was highly significant.

Yoga training for eight weeks improves the autonomic and lung functions.

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