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Comparative Effect of 4 Weeks of Pranayama Breathing Exercise and Respiratory Endurance Training on the Lung Function and Quality of Life on Abdominal Obesity: A Randomised Controlled Trial.

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Abstract: ***World Health Organization (WHO) defines overweight and obesity as abnormal or excessive fat accumulation that presents a risk to health [(1)] Abdominal adiposity markers like Waist Hip Ratio (WHR) and WC may influence pulmonary function through a mechanism that may restrict the descent of the diaphragm and limit lung expansion, compared to overall adiposity, which may compress the chest wall. Thirty subjects of abdominal obesity were randomised into two groups – group A (Pranayama Breathing Exercise) and Group B (Respiratory Endurance Training). Primary outcome measures of treatment with relative parameters such as: Peak flow meter was used to measure FEV1, FVC and FEV1/FVC ratio. HRQOL (Health Related Quality Of Life) (SF-36 Questionnaire) contains 36 questions and used to assess quality of life. Each group contains 15 subjects. The duration of this study is 4 weeks. There is significant difference between two treatments (A and B) in terms of average reduction in FEV_1 ($t = 5.56$, $p = 0 < 0.05$), FVC ($t = -1.293$, $p = 0.2065 > 0.05$), FEV_1/FVC Ratio ($t = -2.11$, $p = 0.02 < 0.05$) and HRQOL (SF-36) Questionnaire ($t = -10.42$, $p = 0 < 0.05$). Hence, the evidence is sufficient to conclude that Treatment A (Pranayama Breathing Exercise) is effective than Treatment B (Respiratory Endurance Training) in terms of average increase in FEV_1, FVC, FEV_1/FVC Ratio and HRQOL (SF-36) Questionnaire.***

Keywords: Abdominal obesity, Incentive Spirometry, Pranayama Breathing Exercise, Waist Circumference

1. Introduction

World Health Organization (WHO) defines overweight and obesity as abnormal or excessive fat accumulation that presents a risk to health. [(1).] Abnormality in the values of FEV_1, FVC and FEV_1/FVC was linked with the components of the metabolic syndrome, most importantly with abdominal obesity and with elevated low-density lipoproteins, hypertension, and insulin resistance. They were independent of age, sex, BMI, history of cardiovascular diseases, smoking, or alcohol use. In this research the PFT measurements were all restrictive lung pattern, which is usually seen in obesity-related lung changes. [(4)]

BMI and waist measurements are well recognized ways to characterize obesity However, waist measurements are better than BMI measurements for Abdominal Obesity. For this reason, it is recommended to use waist measurements. The absolute waist circumference is >102 cm (40 in) in men and >88 cm (35 in) in women. [(5)]

Clinical studies have evaluated the relation of WHR (waist hip ratio) and WC (waist circumference), to poor respiratory functions in both mildly obese and morbidly obese persons. Electronic Peak Flow Meter yields valid measurement of FEV_1 and FVC values which match the accurate criteria of the American Thoracic Society for monitoring devices. [(13)]

Pranayama Breathing Exercise (PBE) is a form of yogic breathing exercise, which facilitates the subjects focusing on muscle relaxation which can be easily learn at the clinic and can be done at home. [(8)] The previous studies exclusively report that PBE are practically acceptable and well adopt by many types of respiratory patients. It has a positive role in reducing dyspnea, improving oxygen capacity, enhancing exercise capacity and improving good quality of life.

Incentive Spirometry is a portable, inexpensive device which is used clinically as a part of the routine prophylactic and therapeutic regimen. [(6)] Since the first Incentive Spirometry was constructed by **Bartlett *et al.*** in the **1970's**, consists of a cylinder and piston with an adjustable volume of 2000-2500 ml, this type of Incentive Spirometry is used as an alternative to IPPB for several years. [(7)] **Bartlett-Edwards** Incentive Spirometry remained standard for many years, later many different types of Incentive Spirometry had been developed, which are less expensive and also single-use units. It is accomplished by the providence of visual feedback; that is, breathing is visualized by an uplifted plate or ball in a transparent cylinder during sustained inspiration, which is activated by an inspiratory effort.

However, the Pranayama Breathing Exercise accomplished by the providence of sensory feedback by touching stomach and helps to improve confidence level. In this study, we compare the effectiveness of the both Pranayama Breathing

Exercise and Respiratory Endurance Training on improving lung function and Quality of Life (SF-36 Questionnaire).

2. Subjects and Methods

The present clinical trial was conducted in various areas in and around Chennai. The study contains both males and females patients above 18 years of age and willing to participate in the study. The purpose of the study was explained to all subjects and consent from each subject was obtained. The subjects were randomly assigned into either Pranayama Breathing Exercises (Group A) and Respiratory Endurance Training (Group B). Patients with Severe Lung disease. Smokers. Severe cardiac condition, Hypertension, Cancer, Post surgical patients, Traumatic condition, Cold were excluded. Pranayama Breathing Exercise and Respiratory Endurance Training was performed for atleast 15 to 20 minutes, for 5 times in a week for 4 weeks duration. Thirty patients, who fulfilled the inclusion criteria are randomly assigned as: Group A (N=15, Male=9, Female=6) received Pranayama Breathing Exercise. Group B (N=15, Male=10, Female=5) received Respiratory Endurance Training.

3. Methodology

For the study, 30 subjects were selected. Subjects were selected in the study on the basis of inclusion criteria (Non – smokers, Patient with no past medical history related to lung condition, Waist Circumference (Men > 40; Female > 35 in inches), Age: 18 to 25). Subjects were evaluated using a special evaluation form. Pulmonary function was assessed by peak flow meter and quality of life was assessed by HRQOL (SF-36) Questionnaire. Subjects were informed about the procedure, merits and demerits of the treatment. Consent is obtained from each subject for voluntary participation. Participants were randomly assigned as Group A and Group B.

4. Procedure

Group A: Pranayama Breathing Exercises (Deep Breath Technique):
The subject was asked to sit or lie down comfortably. Ask them to close their eyes, place their hands on their chest and the other hand on their stomach. Ask them to breathe in deeply through nose (Figure 1) and count to 5. Ask them to feel their stomach rise against their hand. Ask them to breathe out slowly through their mouth (Figure 2). Repeat 10 times / 5 sets with 2 min interval between each sets. Duration-20 min.

Group B: Respiratory Endurance Training (Incentive Spirometry):
Ask the patient to sit comfortably. Ask them to keep the mouth piece of Spirometry into their mouth. Ask them to close their lips tightly. Ask them to breathe in slowly through their mouth as deeply as they can (Figure 3). Try to get the piston as high as they can (Figure 4). When they get it as high as they can, ask them to hold their breath for 10 seconds (Figure 5). While holding breath the piston will slowly fall to the base of the Spirometry. Once the piston reaches the base of Spirometry, breathe out slowly through mouth. Repeat for 10 times / 5 sets with 2 min interval between each set. Duration – 20 min,

Statistical analysis:
The present study included thirty subjects, in which fifteen subjects were on Group A who received Pranayama Breathing Exercise and fifteen subjects were on Group B who received Respiratory Endurance Training. [Table 1], [Table 2] represents demographic data of the study participants

Within group comparison of pre-test and post-test scores in both groups demonstrated reduction in FEV1 scores [Table 3] with $P = 0<0.05$, FVC scores [Table 4] with $P = 0.2065 > 0.05$, FEV1/FVC ratio [Table 5] with $P = 0.02 < 0.05$ and HRQOL scores [Table 6] with $P = 0 < 0.05$.

5. Results

Pranayama Breathing Exercise:
The baseline mean difference of FEV_1 for Pranayama Breathing Exercise was 293.33 and SD was 55.76. After the end of four weeks the mean difference was 417.33 and SD was 53.11 (t=11.81). The baseline mean difference of FVC for Pranayama Breathing Exercise was 426 and SD was 53.42. After the end of four weeks the mean difference was 516 and SD was 57.17 (t=22.37). The baseline mean difference of FEV_1/FVC for Pranayama Breathing Exercise was 0.68 and SD was 0.073. After the end of four weeks the mean difference was 0.81 and SD was 0.085 (t=5.108). Similarly, the baseline mean difference of HRQOL (SF-36) Questionnaire for Pranayama Breathing Exercise was 41.19 and SD was 5.03. At the end of four weeks the mean difference was 51.01 and SD was 5.725 (t=15.70). From these outcome measures, this findings shows that Pranayama Breathing Exercise is effective on improving the lung function and quality of life of abdominal obesity.

Respiratory Endurance Training:
The baseline mean difference of FEV_1 for Respiratory Endurance Training was 245.33 and SD was 63.12. After the end of four weeks the mean difference was 327.33 and SD was 68.08 (t=27.70). The baseline mean difference of FVC for Respiratory Endurance Training was 362 and SD was 57.96. After the end of four weeks the mean difference was 442.67 and SD was 56.25 (t=18.27). The baseline mean difference of FEV_1/FVC for Respiratory Endurance Training was 0.08 and SD was 0.086. After the end of four weeks the mean difference was 0.088 and SD was 0.088 (t=11.58). Similarly, the baseline mean difference of HRQOL (SF-36) Questionnaire for Respiratory Endurance Training was 40.25 and SD was 6.64. At the end of four weeks the mean difference was 48.375 and SD was 6.9 (t=18.7). From these outcome measures, this findings shows that Respiratory Endurance Training is effective on improving the lung function and quality of life of abdominal obesity.

6. Conclusion

Both the treatments (Pranayama Breathing Exercise and Respiratory Endurance Training) are more effective on lung function and Quality of Life (SF-36 Questionnaire). These

treatments also reduce the size of waist circumference but not for all subjects. It's not taken as outcome measures and not explained clearly. Further studies may concentrate on waist circumference. On comparing both the treatments, Pranayama Breathing Exercise is highly effective on improving lung function and Quality of Life (SF-36 Questionnaire).

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Pictures:

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Tables:

Table 1

S. No	Age / Sex	Height	Weight	WC	Pulmonary Function (PRE)			Pulmonary Function (POST)		
					FEV_1	FVC	FEV_1 /FVC Ratio	FEV_1	FVC	FEV_1 /FVC Ratio
1	22/M	171cm	73kg	40 inches	270	390	0.6923	410	470	0.87234
2	23/M	167cm	68kg	43 inches	340	480	0.7083	520	590	0.88136
3	21/M	161cm	84kg	40 inches	390	510	0.7647	430	630	0.68254
4	21/M	174cm	77kg	40 inches	210	390	0.5385	400	460	0.86957
5	22/M	176cm	70kg	41 inches	250	390	0.641	380	480	0.79167
6	20/M	168cm	72kg	40.5 inches	330	450	0.7333	470	530	0.88679

7	21/F	169cm	67kg	36 inches	360	470	0.766	490	560	0.875
8	22/F	173cm	70kg	38 inches	270	430	0.6279	380	510	0.7451
9	21/M	172cm	70kg	40 inches	250	410	0.6098	370	490	0.7551
10	21/F	168cm	58kg	35 inches	280	360	0.7778	390	480	0.8125
11	21/F	154cm	61kg	35 inches	210	360	0.5833	340	460	0.73913
12	21/F	161cm	53kg	35 inches	320	490	0.6531	360	570	0.63158
13	21/F	168cm	71kg	38.5 inches	280	400	0.7	420	490	0.85714
14	24/M	167cm	73kg	43 inches	370	500	0.74	490	580	0.84483
15	18/M	165cm	70kg	40 inches	270	360	0.75	410	440	0.93182
16	24/M	170cm	112kg	53 inches	210	400	0.525	290	480	0.604167
17	22/M	168cm	78kg	41 inches	310	420	0.7381	380	490	0.77551
18	21/F	168 cm	72 kg	40 inches	260	390	0.66667	350	450	0.777778
19	21/M	157 cm	108 kg	50 inches	190	310	0.6129	270	400	0.675
20	22/M	165cm	77kg	41 inches	350	460	0.76087	440	530	0.830189
21	24/M	171cm	85kg	40 inches	160	270	0.59259	230	360	0.638889
22	19/F	161cm	67kg	40 inches	250	380	0.65789	360	510	0.705882
23	23/M	159cm	89kg	40 inches	220	310	0.70968	290	390	0.74359
24	21/M	170cm	78 kg	41 inches	390	450	0.86667	480	510	0.941176
25	22/F	152cm	67kg	37 inches	230	320	0.71875	310	390	0.794872
26	21/F	168cm	57kg	35 inches	240	330	0.72727	330	410	0.804878
27	21/F	168cm	60 kg	36.5 inches	210	370	0.56757	280	450	0.622222
28	23/M	165cm	89kg	48 inches	190	300	0.63333	260	370	0.702703
29	21/M	169cm	76kg	43inches	200	320	0.625	290	410	0.707317
30	20/M	170cm	77kg	40 inches	270	400	0.675	350	490	0.714286

Table 2

S. No	Age /Sex	Height	Weight	WC	HRQOL (SF-36) (PRE)	HRQOL (SF-36) (POST)
1	22/M	171cm	73kg	40 inches	41.11	49.33
2	23/M	167cm	68kg	43inches	46.39	51.7
3	21/M	161cm	84kg	40 inches	44.3	53.1
4	21/M	174cm	77kg	40 inches	44.72	56.7
5	22/M	176cm	70kg	41 inches	41.67	50.32
6	20/M	168cm	72kg	40.5 inches	35.83	42.96
7	21/F	169cm	67kg	36 inches	42.91	51.48
8	22/F	173cm	70kg	38 inches	35	43.37
9	21/M	172cm	70kg	40 inches	48.75	59.14
10	21/F	168cm	58kg	35 inches	41.53	52.77
11	21/F	154cm	61kg	35 inches	43.75	56.11
12	21/F	161cm	53kg	35 inches	35.83	43.8
13	21/F	168cm	71kg	38.5 inches	47.08	61
14	24/M	167cm	73kg	43 inches	37.5	49.18
15	18/M	165cm	70kg	40 inches	31.53	44.33
16	24/M	170cm	112kg	53 inches	29.86	37.46
17	22/M	168cm	78kg	41 inches	44.86	50.14
18	21/F	168 cm	72 kg	40 inches	33.33	41.7
19	21/M	157 cm	108 kg	50 inches	45.28	53
20	22/M	165cm	77kg	41 inches	45.27	51.75
21	24/M	171cm	85kg	40 inches	34.86	40.11
22	19/F	161cm	67kg	40 inches	30.14	39.98
23	23/M	159cm	89kg	40 inches	47.64	58.3
24	21/M	170cm	78 kg	41 inches	42.08	50.79
25	22/F	152cm	67kg	37 inches	49.17	57.4
26	21/F	168cm	57kg	35 inches	37.08	45.01
27	21/F	168cm	60 kg	36.5 inches	38.05	46.37
28	23/M	165cm	89kg	48 inches	45.83	53.06
29	21/M	169cm	76kg	43inches	46.25	57.23
30	20/M	170cm	77kg	40 inches	34.03	43.33

Table 3: t-Test: Two-Sample Assuming Equal Variances

	A_ FEV_1_Diff	*B_ FEV_1_Diff*
Mean	**124**	**82**
SD	**40.67**	**11.46**
Variance	1654.29	131.43
Observations	15	15
Pooled Variance	892.86	
Hypothesized Mean Difference	0	
Df	28	
t Stat	**5.56**	
P (T<=t) one-tail	0.000	
t Critical one-tail	1.76	
P (T<=t) two-tail	**0.000**	
t Critical two-tail	2.14	

Table 4: t-Test: Two-Sample Assuming Equal Variances

	A_ FVC _Diff	*B_ FVC _Diff*
Mean	**90**	**80.67**
SD	**15.58**	**17.1**
Variance	242.86	292.38
Observations	15	15
Pooled Variance	267.62	
Hypothesized Mean Difference	0	
Df	28	
t Stat	**-1.293**	
P (T<=t) one-tail	0.103	
t Critical one-tail	1.76	
P (T<=t) two-tail	**0.206**	
t Critical two-tail	2.14	

Table 5: t-Test: Two-Sample Assuming Equal Variances

	A_ FEV_1/FVC Ratio _Diff	*B_ FEV_1/FVC Ratio _Diff*
Mean	**0.13**	**0.06**
SD	**0.096**	**0.02**
Variance	0.009	0.0004
Observations	15	15
Pooled Variance	0.005	
Hypothesized Mean Difference	0	
Df	28	
t Stat	**-2.11**	
P (T<=t) one-tail	0.021	
t Critical one-tail	1.76	
P (T<=t) two-tail	**0.044**	
t Critical two-tail	2.14	

Table 6: t-Test: Two-Sample Assuming Equal Variances

	*A*_HRQOL (SF-36) *_Diff*	*B_* HRQOL (SF-36) *_Diff*
Mean	**9.826**	**8.13**
SD	**2.42**	**1.68**
Variance	5.87	2.83
Observations	15	15
Pooled Variance	4.35	
Hypothesized Mean Difference	0	
Df	28	
t Stat	**-10.42**	
P (T<=t) one-tail	0.000	
t Critical one-tail	1.76	
P (T<=t) two-tail	**0.000**	
t Critical two-tail	2.14	

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