# The Effect of Structured Physiotherapy Exerciseprogramme on Lung Function in Industrial Workers

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## Abstract

**Context:** Repeated exposure to dusty environment in an industry causes airway diseaseswhich may affect pulmonary function over a period of time. **Aim**:The effects of structured physiotherapy exercises programme on lung function in sugarcane industrial workers**Study Design:** An experimental study was conducted on 60 sugar factory workers at in and around karadarea.**Purpose of the study:** To find out the effect of structured physiotherapy exercise programme on lung function in industrial workers. **MaterialsAnd Methodology**: -60workers of age group 20-40 from sugar industry participated in this study. They were bounded in single group. The subjects were scrutinized based on the inclusion criteria. All the subjects signed a consent form prior to participation in the study. Before receiving any intervention, the peak expiratory flow rate and 6min walk test was taken and abdominal strength checked by manual muscle testing of abdominal muscle (graded abdominal muscle testing). After recording the pre-intervention outcome measure,The specific exercise protocol was given to the subjects which was included abdominal muscle exercises (graded abdominal muscle exercises)and 6 minute walk test as exercises purpose and diaphragmatic breathing exercises (10 repetition for 3 sets), segmental breathing exercises (10 repetition for 3 sets), incentive spirometry (20 repetition 5 sets).post treatment outcome measure were performed for peak expiratory flow rate,and abdominal muscle strength and 6 minute walk distance. Statistical analysis was done using paired' test.**Result:**In this study pre-intervention peak expiratory flow rate was 290±58.251 and post-intervention peak expiratory flow rate was 307±60.914.In peak expiratory flow rate statistically extremely significant difference and increasing peak expiratory rate post intervention with ($p<0.0001$) with $t=5.633$ with 59 degree of freedom.The six-minute walk distance (6mwd) increased from 215 to 297 meter.In the study the pre intervention values of abdominal muscle strength (MMT or grades of abdominal muscle) was 1.63± 0.7357 and post intervention abdominal muscle strength was 2.5± 0.7249.In abdominal muscle strength statistically extremely significant difference and increases abdominal muscle strength with ($p<0,0001$) with $t=11.851$ with 59 degree of freedom.**Conclusion:**-Thus, the above study concluded that a structured exercisesprogramme showed a significant improvement clinically as well as statistically significanton the peak expiratory flow rate and 6-minute walk distance and abdominal muscle strength in the sugar industry workers. Hence it accepts the alternate hypothesis.

*Keywords:PEFR ,6minute walk distance, graded abdominal muscle exercises, Breathing exercises.*

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## Introduction

Maharashtra is one of the largest sugar producers state in India. "Bagassosis" is a respiratory disease. Bagasse is a by-product of sugarcane crushing, size range from 0.5–3 microns are called as repairable dust, to which sugar factory workers are exposed by virtue of their occupation.Respiratory disease is today an important clinical problem for industrial workers. Significantly increased risk of respiratory morbidity

and mortality among industrial workers.Bagassosis, an interstitial lung disease, is a type of hypersensitivity pneumonitis attributed to exposure to moldy molasses. It reduced FVC, TLC, PEFRin bagassosis patients. Since 1970 very few pulmonary function studies were reported in this field until recently in 2008 a study in western Maharashtra reported decreasing FVC, FEV1, PEFR in occupationally exposed groups to bagasse as compared to non-exposed group. However, this study was conducted during the operational period of a sugar factory[1,3,4,8,9].

**Peak Expiratory Flow Rate [3,11,19]**

The peak expiratory flow (PEF), also called peak expiratory flow rate (PEFR) is a person's maximum speed of expiration, as measured with a peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways.

Graded abdominal muscle exercises include[2,12,20,21]

Upper abdominal exercises-

Starting position-The subjects were instructed to lie in supine with the hips at 45 degree and knees at 90 degree and hand at sides. In all these activities subjects were instructed to keep the low back flat.

Grade1-subjects were asked to perform the curl ups by contracting abdominal muscles and then lifting the head off table with flexed knees.

Grade 2-the progression was made by lifting the shoulders until the top of scapulae lift from table, keeping the arms extended towards knees.

Grade 3- The next progression was done by lifting the shoulders until the scapulae clear table, keeping the arms horizontal.

Grade 4- The subjects were asked to progresses further by keeping the arms crossed over chest, until scapulae clear table.

Grade 5- The subjects were asked to progress the difficulty of the curl ups by having the subject change the arm position from horizontal and then to behind the neck, until scapulae clear table.

6minute walk test provides simple, inexpensive, non-invasive method for assessing cardiac or pulmonary functional capacity. The 6-minute walk test measures the distance an individual is able to walk over 6 minutes. The goal is for individual to walk as far as possible in 6 minutes. The individual is allowed to self-pace and rest as needed as they traverse back and forth along a marked walking. The vitals should be noted prior as well as after the test. 6-minute walk test is used for measuring the response to medical interventions in patient with moderate to severe heart or lung diseases. 6-minute walk test has also been used as a one-time measure of functional status of patient as well as a predictor of morbidity and mortality[5,6,10].

**PARTICIPANTS**

60 workers of age group 20-40 from sugar industry participated in this study. They were bounded in single group. The subjects were scrutinized based on the inclusion criteria. All the subjects signed a consent form prior to participation in the study. Before receiving any intervention, the peak expiratory flow rate and 6min walk test was taken and abdominal strength checked by manual muscle testing of abdominal muscle (graded abdominal muscle testing). After recording the pre-intervention outcome measure,The specific exercise protocol was given to the subjects which was included abdominal muscle exercises (graded abdominal muscle exercises)and 6 minute walk test as exercises purpose and diaphragmatic breathing exercises (10 repetition for 3 sets), segmental breathing exercises (10 repetition for 3 sets), incentive spirometry (20 repetition 5 sets).post treatment outcome measure were performed for peak expiratory flow rate,and abdominal muscle strength and 6 minute walk test distance. Statistical analysis was done using paired' test.

**Outcome Measures:**

**1. Peak expiratory flow rate[2,10,19]-:** The peak expiratory flow (PEF), also called peak expiratory flow rate (PEFR) is a person's maximum speed of expiration, as measured with a peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways.

**2. MMT for abdominal muscle[2,20,21] –**

Graded abdominal muscle exercises include

Upper abdominal exercises-

Starting position-The subjects were instructed to

lie in supine with the hips at 45 degree and knees at 90 degree and hand at sides. In all these activities subjects were instructed to keep the low back flat.

Grade1-subjects were asked to perform the curl ups by contracting abdominal muscles and then lifting the head off table with flexed knees.

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**3. 6minute walk test** provides simple, inexpensive, non-invasive method for assessing cardiac or pulmonary functional capacity. The 6-minute walk test measures the distance an individual is able to walk over 6 minutes. The goal is for individual to walk as far as possible in 6 minutes. The individual is allowed to self-pace and rest as needed as they traverse back and forth along a marked walking. The vitals should be noted prior as well as after the test. 6-minute walk test is used for measuring the response to medical interventions in patient with moderate to severe heart or lung diseases. 6-minute walk test has also been used as a onetime measure of functional status of patient as well as a predictor of morbidity and mortality.[5,6]

## Methodology

60 workers of age group 20-40 from sugar industry participated in this study. They were bounded in single group. The subjects were scrutinized based on the inclusion criteria. All the subjects signed a consent form prior to participation in the study. Before receiving any intervention, the peak expiratory flow rate and 6min walk test was taken and abdominal strength checked by manual muscle testing of abdominal muscle (graded abdominal muscle testing). After recording the pre-intervention outcome measure,The specific exercise protocol was given to the subjects which was included abdominal muscle exercises (graded abdominal muscle exercises)and 6 minute walk test as exercises purpose and diaphragmatic breathing exercises (10 repetition for 3 sets), segmental breathing exercises (10 repetition for 3 sets)[12,13], incentive spirometry (20 repetition 5 sets).post treatment outcome measure were performed for peak expiratory flow rate,and abdominal muscle strength and 6 minute walk test distance. Statistical analysis was done using paired' test.

## Results

**1) Peak Expiratory Flow Rate:**The pre intervention peak expiratory flow rate value were 290 ± 58.251, whereas post intervention the value was 307.33 ± 60.914.the post intervention change in peak expiratory flow rate values showed statistically extremely significant. The "P" value is <0.0001 considered extremely significant. This was done using paired' test. 't' value is t=5.633 with 59 degree of freedom

**2) Manual Muscle Testing :**

The pre interventional MMT value was 1.63±O.7357 whereas post interventional the value was 2.5±O.7249. the post interventional change in value showed statistically extremely significant. The "P" value is <0.0001 considered extremely significant. this was doing using paired" t" test. the "t" value is t=11.851with 59-degree freedom.

**3) 6 minute walk test:**

The pre interventional 6mwd value was 1.63±o.7357 whereas post interventional the value was 2.5±o.7249.the post interventional change in value showed statistically extremely significant. The "p" value is <0.0001 considered extremely significant. this was doing using paired" t" test. the "t" value is t=11.851with 59-degree freedom.

**1.Peak Expiratory Flow Rate -**

**Table 1: Mean and standard deviation of pefr**

| Pefr | Pre Pefr | Post Pefr |
|---|---|---|
| MEAN | 290 | 307.33 |
| SD | 58.251 | 60.914 |

**2.Manual Muscle Testing:**

**Table 2: Mean and SD of MMT**

| MMT | PRE MMT | POST MMT |
|---|---|---|
| MEAN | 1.63 | 2.5 |
| SD | 0.7357 | 0.7249 |

3.6 MINUTE WALK DISTANCE:

**TABLE 3: MEAN AND SD OF 6MWD**

| **6MWD** | **Pre 6MWD** | **Post 6MWD** |
|---|---|---|
| Distance | 215 | 310 |
| Mean ±SD | 307.8±46.0 | 344.5±64.5 |

## Discussion

Maharashtra is one of the largest sugar producers state in India. "Bagassosis" is a respiratory disease. Bagasse is a by-product of sugarcane crushing, size range from 0.5–3 microns are called as repairable dust, to which sugar factory workers are exposed by virtue of their occupation. Respiratory disease is today an important clinical problem for industrial workers. Significantly increased risk of respiratory morbidity and mortality among industrial workers. Bagassosis, an interstitial lung disease, is a type of hypersensitivity pneumonitis attributed to exposure to moldy molasses. It reduced FVC, TLC, PEFR in bagassosis patients. Since 1970 very few pulmonary function studies were reported in this field until recently in 2008 a study in western Maharashtra reported decreasing FVC, FEV1, PEFR in occupationally exposed groups to bagasse as compared to non-exposed group. However, this study was conducted during the operational period of a sugar factory.[1]Nikhade N., Sharma P conducteda Study Of Pulmonary Function Test In this study Workers Of Sugar Factory, Pravaranagar, Maharashtra, in this study Significant reduction of FEV1 in Bagasse workers, Manufacturing department and Engineering department workers as compared with controls, indicated obstructive type of pulmonary abnormalities. Reduced FEV1 has earlierbeen reported by Bohadana et al[23] showed thatworkers exposed to sugar dust in the sugar cubemanufacture workstation had significantly lowerforced expiratory volume in 1s (FEV1) than thenon-exposed ones.ThePeak Expiratory Flow Rate (PEFR) was reduced inall the exposed workers in sub-occupational groupsbeing higher in Bagasse workersfollowed by Manufacturing department.A highlysignificant decrease in PEFR was also reportedfrom western Maharashtra by Patil S.N.[3] PEFR isan index of expiratory airway resistance and ismore effort dependent . The reduction in PEFRmay involve the same mechanism alreadyexplained for obstructive lesion. In addition, theinflammatory reaction releases proteins fromeosinophils which might be responsible for thehyper responsiveness of airways. In this study 60 sugar industrial workers of age 20-40 years in Karadarea were been participated in the study. They were bounded in single group. The pre outcome measure was peak expiratory flow rate, abdominal strength and 6minute walk distance. Peak expiratory flow ate measured by peak expiratory flow rate device, 6minute walk distance was measured by 6min walk test abdominal muscle strength measured by grades of abdominal muscle. The specific exercise protocol was given to the subjects which was included abdominal muscle exercises (graded abdominal muscle exercises)and 6 minute walk test as exercises purpose and diaphragmatic breathing exercises (10 repetition for 3 sets), segmental breathing exercises (10 repetition for 3 sets), incentive spirometry (20 repetition 5 sets).post treatment outcome measure were performed for peak expiratory flow rate,and abdominal muscle strength and 6 minute walk test distance. Statistical analysis was done using paired' test.In this study pre-intervention peak expiratory flow rate was 290±58.251 and post-intervention peak expiratory flow rate was 307±60.914. In peak expiratory flow rate statistically extremely significant difference and increasing peak expiratory rate post intervention with ($p<0.0001$) with $t=5.633$ with 59 degree of freedom. The six-minute walk distance (6mwd) increased from 215 to 297 meter.In the study the pre intervention values of abdominal muscle strength (MMT or grades of abdominal muscle) was 1.63± 0.7357 and post intervention abdominal muscle strength was 2.5± 0.7249.In abdominal muscle strength statistically extremely significant difference and increases abdominal muscle strength with ($p<0,0001$) with $t=11.851$ with 59 degree of freedom .Thus, the above study concluded that a structured exercisesprogramme showed a significant improvement clinically as well as statistically significant on the peak expiratory flow

rate and 6 minute walk distance and abdominal muscle strength in the sugar industry workers. Hence it accepts the alternate hypothesis.

**Limitations:**

1. The sample size was small.
2. Limited literature review on industrial workers
3. Limited literature review on peak expiratory flow rate
4. Limited literature review on structured physiotherapy exercises programme on industrial workers

## Conclusion

Thus, the above study concluded that a structured exercise programme showed a significant improvement clinically as well as statistically on the peak expiratory flow rate, abdominal muscle strength and 6-minute walk distance in the sugar industry workers. hence it accepts the alternate hypothesis

**Conflicts of Interest:** Nil

**Source of Funding:** Krishna Institute Of Medical Sciences Deemed University, Karad.

**Ethical Clearance:** Study approved by Institutional ethics committee of Krishna institute of medical sciences deemed to be university, Karad.

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