Research Article

A Pre-Experimental Study to Assess the Effectiveness of Deep Breathing Exercises on the Respiratory Status among Petrol Pump Workers from Selected Areas of Pune City

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Abstract

Introduction: The respiratory rate is the rate at which breathing occurs; it is set and controlled by the respiratory center of the brain. A person's respiratory rate is usually measured in breaths per minute. The respiratory rate in humans is measured by counting the number of breaths for one minute through counting how many times the chest rises. A fibre-optic breath rate sensor can be used for monitoring patients during a magnetic resonance imaging scan. Respiration rates may increase with fever, illness, or other medical conditions [1].
Aims of the Study: The study aims to assess the effectiveness of deep breathing exercises in improving the respiratory status of petrol pump workers in selected areas of Pune city. It also seeks to evaluate any measurable changes in respiratory parameters following the intervention.
Methodology: The present study followed a quantitative research approach using a pre-experimental one-group pretest–post-test design. Data was collected from petrol pump workers in selected areas of Pune city. Based on the sample size calculation, 60 participants were included, selected through a non-probability purposive sampling method. To evaluate the effectiveness of deep breathing exercises on the respiratory status of workers, a structured questionnaire was used, and the reliability of the tool was assessed using the test–retest method. The investigator computed the r-value, which was found to be +0.9720, indicating a high level of reliability.
Results: Most participants were middle-aged males with secondary or lower education, prolonged exposure to petrol/diesel fumes, smoking habits, and poor use of protective equipment—factors that increased their risk of respiratory problems. Pre-test findings showed that 68.33% had low respiratory status, indicating poor respiratory health. Post-test results revealed a marked improvement, with 85% of participants achieving high or adequate respiratory status and none remaining in the low category. The t-test showed the intervention was highly effective ($t = 22.59$, $p = 0.00001$), and chi-square analysis indicated no significant association between respiratory status and demographic variables.
Conclusion: Deep breathing exercises were found to be highly effective in improving the respiratory status of petrol pump workers. A significant difference between pre- and post-test scores confirmed the intervention's effectiveness, while demographic variables showed no significant association. This highlights deep breathing as a simple, low-cost, and feasible method to promote respiratory health among workers exposed to harmful fumes.

Keywords: Pre-Experimental Study, Assess, Effectiveness, Deep Breathing Exercises, Respiratory Status, petrol pump workers.

Introduction

Breathing is the rhythmical process of moving air into (inhalation) and out of (exhalation) the lungs to facilitate gas exchange with the internal environment, mostly to flush out carbon dioxide and bring in oxygen. All aerobic creatures need oxygen for cellular respiration, which extracts energy from the reaction of oxygen with molecules derived from food and produces carbon dioxide as a waste product. Breathing, or external respiration, brings air into the lungs where gas exchange takes place in the alveoli through diffusion [2].

A relaxation technique in which a person focuses on taking slow, deep breaths. Deep breathing may be used to help relieve stress, pain, and anxiety. Also called abdominal breathing and diaphragmatic breathing [3].

DBE is a broad term that encompasses several types of non-resisted, paced breathing strategies, including yogic breathing or Pranayama, diaphragmatic breathing, and abdominal breathing, to name a few. For example, two studies purporting to investigate "diaphragmatic breathing" may differ in the employed breathing frequency (breaths/minute), the fraction time spent inhaling and exhaling per breath, the utilization of nose or mouth breathing, the amount of time spent per day performing DBE, or the time of day that the intervention is performed, along with many other variables [4].

Breathing in this manner allows the individual to inhale more air than normal shallow breathing. Deep breathing has been shown to release stress and tension, build energy and endurance, help with pain management, and to enhance mental concentration and physical performance. It can be taught as part of another relaxation technique or alone. Deep breathing usually is easily taught in one therapeutic session and has the advantage that it can easily and unobtrusively be used by clients during the day whenever a stressful situation emerges [4, 5].

Need of the Study

Petrol pump workers are chronically exposed to vehicular emissions and volatile organic compounds, such as benzene, toluene, and xylene, which are known to have harmful effects on the respiratory system. Prolonged exposure to these pollutants can lead to respiratory issues like chronic bronchitis, asthma, reduced lung function, and other pulmonary disorders. A study by Sharma et al. [8] found that petrol pump workers exhibited significantly lower forced expiratory volume (FEV1) and forced vital capacity (FVC) compared to healthy controls.

A cross-sectional study conducted among 158 male workers from 11 selected petrol pumps in Bengaluru aimed to assess their awareness and the prevalence of respiratory morbidities. Most participants were aged 18–27 years (65.19%) and had completed high school (49.37%). After obtaining ethical clearance, socio-demographic details, knowledge levels, and health status were collected, along with medical examinations and Peak Expiratory Flow Rate (PEFR) assessments. The findings revealed that 56% of the workers had awareness about respiratory conditions, while the prevalence of respiratory morbidities was 61%, highlighting a significant occupational health concern [6].

Petrol pump workers are frequently exposed to harmful petrol and diesel fumes, increasing their risk of respiratory problems. These issues are often exacerbated by smoking habits and inconsistent use of protective equipment, leading to decreased respiratory function and overall health. Impaired respiratory status negatively impacts workers' productivity and quality of life [7].

The aim of the study was to assess the effectiveness of deep breathing exercises on the respiratory status of petrol pump workers in selected areas of Pune city. The study compared respiratory status before and after the intervention among the selected workers. It also examined the statistical significance of the observed change.

Aim of the Study

The study aimed to evaluate and compare respiratory status before and after the intervention. It also sought to determine the effectiveness of deep breathing exercises in improving respiratory status among petrol pump workers.

Research Methodology

Objectives of the Study

1. To assess the respiratory status of petrol pump workers before and after deep breathing exercises.
2. To evaluate the effectiveness of deep breathing exercises on respiratory status among petrol pump workers.

Research Type: Quantitative research approach.

Research Design: Pre-experimental one-group pretest–posttest design.

Sample and Sample Size: The study included 60 petrol pump workers aged 18–60 years from selected areas of Pune city, having at least one year of work experience and no chronic respiratory or cardiovascular conditions.

Sampling Technique: Non-probability purposive sampling technique.

Tool Description

Section I: Demographic variables of petrol pump workers.

Section II: Structured respiratory status questionnaire to assess respiratory status before and after deep breathing exercises.

Reliability: The reliability of the tool was established using the test–retest method, with a correlation coefficient of r = +0.9720, indicating high reliability.

Pilot Study: A pilot study was conducted among 6 petrol pump workers to assess the feasibility of the study.

Statistical Analysis: Data were analysed using descriptive and inferential statistics, including a paired t-test, to evaluate the effectiveness of deep breathing exercises.

Data were collected using a structured tool consisting of two sections: Section I included demographic variables, and Section II included a respiratory status questionnaire.

Reliability: The reliability of the tool was established using the test–retest method, yielding a correlation coefficient of r = +0.9720, indicating high reliability.

Results

SECTION-I

Section-I - Demographic data of the sample.

Table 1 Demographic Profile.

n=60

Demographic Variables	F	%
1. Age		
a. 18-30 year	12	20.00

b. 31-40 years	10	16.67
c. 41-50 years	25	41.67
d. 51-60 years	13	21.67
2. Gender		
a. Male	34	56.67
b. Female	26	43.33
c. Other	0	0.00
3. Marital status		
a. Married	48	80.00
b. Unmarried	12	20.00
4. Education Status		
a. No formal education	11	18.33
b. Primary education	18	30.00
c. Secondary Education	21	35.00
d. Other	10	16.67
5. Years of experience at petrol pump		
a. Less than 1 year	10	16.67
b. 1-5 year	13	21.67
c. 6-10 year	28	46.67
d. More than 10 years	9	15.00
6. Daily average exposure to Petrol / Diesel fumes		
a. 0-30 Min	5	8.33
b. 1-3 Hours	13	21.67
c. 3-5 hours	20	33.33
d. More than 5 hours	22	36.67
7. Smoking habit		
a. Yes	41	68.33
b. No	19	31.67
8. Use of Protective eqiupment (mask)		
a. Always	10	16.67
b. Sometimes	20	33.33
c. Never	30	50.00
9. History of Respiratory diseases?		
a. Yes	11	18.33
b. No	49	81.67
10. Any Prior Knowledge / Practice of deep breathing exercises?		
a. Yes	3	5.00
b. No	57	95.00

The demographic profile of the petrol pump workers showed that the largest age group was 41-50 years (41.67%), followed by 51-60 years (21.67%), 18-30 years (20%), and 31-40 years (16.67%). Males constituted a slight majority at 56.67%, while females made up 43.33%. Most participants were married (80%). Regarding education, 35% had secondary education, 30% had primary education, 18.33% had no formal education, and 16.67% had other educational backgrounds. Nearly half (46.67%) had 6-10 years of work experience, with others spread across less than 1 year to more than 10 years. Daily exposure to petrol or diesel fumes was high, with 70% exposed for more than 3 hours. Smoking was prevalent among 68.33% of workers. Protective equipment use was inconsistent, with half never using masks. A minority (18.33%) reported

a history of respiratory diseases. Almost all (95%) had no prior knowledge or practice of deep breathing exercises, indicating limited awareness of this potential respiratory health intervention.

SECTION II Section II: Data related to assess the respiratory status of petrol pump worker's from selected areas of Pune city

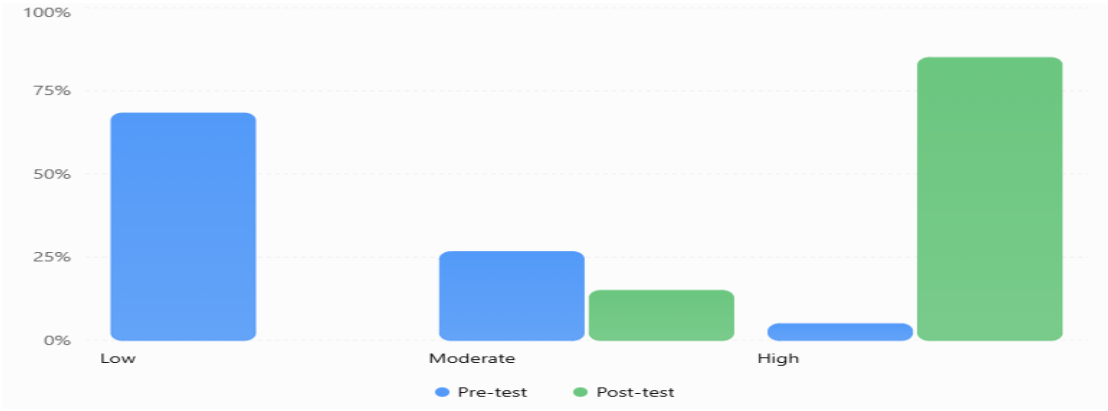


Figure 1: Percentage-wise Comparison of Pre-test and Post-test Levels of Respiratory Status among Petrol Pump Workers (n = 60)

■ Pre-test
■ Post-test

Interpretation: Figure 1 illustrates the percentage-wise distribution of pre-test and post-test respiratory status among petrol pump workers in selected areas of Pune city. The pre-test findings revealed that the majority of workers (68.33%) had low respiratory status, followed by 26.67% with moderate respiratory status and only 5% with high respiratory status. Following the administration of deep breathing exercises, a considerable improvement was observed, with 85% of workers achieving high respiratory status, 15% remaining in the moderate category, and none in the low category. The mean respiratory status score increased from 14.45 ± 4.57 in the pre-test to 32.35 ± 4.07 in the post-test. These findings indicate a substantial improvement in respiratory status following the intervention, suggesting that deep breathing exercises were effective in improving respiratory status among petrol pump workers.

SECTION -III

Data related to Effectiveness of Deep breathing exercise on petrol pump worker's from selected areas of Pune city.

Table No.2 - Related to compare the Effectiveness of Deep breathing exercise on petrol pump worker's before and after the intervention. n=60

EFFECTIVENESS OF DEEP BREATHING EXERCISES ON THE RESPIRATORY STATUS	Mean	SD	DF	T test calcaluated value	P value	Remark
Pre test	14.45	4.57	59	22.59	0.00001	Significant
Post test	32.35	4.07				

The comparison of pre-test and post-test respiratory status scores clearly demonstrates the significant effectiveness of deep breathing exercises among petrol pump workers in selected areas of Pune city. The mean respiratory status score improved markedly from 14.45 ± 4.57 before the intervention to 32.35 ± 4.07 after the intervention, indicating a substantial enhancement in lung function and overall respiratory health. The calculated t-value of 22.59 with 59 degrees of freedom and a p-value of 0.00001 confirms that this improvement is statistically highly significant, well below the 0.05 threshold. These results suggest that the structured deep breathing exercise program is a simple, low-cost, and non-invasive intervention that can be effectively implemented to improve respiratory status in workers exposed to petrol and diesel fumes.

SECTION -IV

Section- IV: Finding related to an association with selected demographic variables.

The chi-square test was applied to determine the association between the respiratory status of petrol pump workers and their selected demographic variables. The findings revealed that none of the demographic factors showed a statistically significant association with respiratory status, as all calculated chi-square values were less than the table values at the 0.05 level of significance. Age ($\chi^2 = 0.854$, $p = 0.991$), gender ($\chi^2 = 0.129$, $p = 0.998$), marital status ($\chi^2 = 0.355$, $p = 0.837$), education status ($\chi^2 = 2.495$, $p = 0.869$), years of experience ($\chi^2 = 0.845$, $p = 0.991$), daily exposure to petrol/diesel fumes ($\chi^2 = 1.742$, $p = 0.942$), smoking habit ($\chi^2 = 1.696$, $p = 0.428$), use of protective equipment ($\chi^2 = 0.796$, $p = 0.939$), history of respiratory diseases ($\chi^2 = 0.163$, $p = 0.922$), and prior knowledge/practice of deep breathing exercises ($\chi^2 = 0.513$, $p = 0.774$) were all found to be not significant. This indicates that respiratory status among petrol pump workers was not influenced by any single demographic variable, suggesting that respiratory health issues may result from a combination of occupational exposure and lifestyle factors rather than demographic characteristics alone.

Discussion

The present study aimed to evaluate the effectiveness of deep breathing exercises on the respiratory health of petrol pump workers in selected areas of Pune city. Initially, the pre-test respiratory status revealed that 68.33% of participants had low respiratory status, with a mean score of **14.45 (SD = 4.57)**, indicating compromised lung function. Following the intervention, the post-test mean score significantly improved to **32.35 (SD = 4.07),** with 85% of workers achieving high or adequate respiratory status. The paired t-test showed a t-value **of 22.59 (df = 59)** with a highly significant p-value of 0.00001, confirming the effectiveness of deep breathing exercises in enhancing respiratory health among the workers. This highlights the value of simple, non-invasive interventions in improving respiratory function.

In a similar study by **Srivastava and Barkule's** [9] cross-sectional study revealed that petrol pump workers in Aurangabad suffer from significant respiratory impairment and increased psychological distress due to exposure to petrol and diesel fumes. Their findings highlight the serious health risks faced by these workers, providing important context for the current study, which demonstrates that deep breathing exercises can effectively improve respiratory health. **Ameen et al.'s** [10] study in Erbil City documented a high prevalence of respiratory symptoms among petrol pump workers and noted poor use of protective equipment despite awareness of risks. While their study focused on identifying respiratory problems, the current study adds value by showing that deep breathing exercises are an effective, low-cost intervention to improve respiratory function in this vulnerable group. The results should nevertheless be interpreted in the context of a one-group pretest–post-test design. Without a concurrent control group, changes may also reflect repeated assessment, background variation, or other influences occurring during the intervention period. The study used a respiratory status questionnaire rather than reporting spirometric measurements, so the outcome is best described as an improvement in assessed respiratory status. The sample comprised 60 purposively selected workers from selected areas of Pune city, which limits the extent to which the findings can be generalized. These considerations do not negate the observed statistically significant change, but they underscore the need for controlled studies with longer follow-up and objective respiratory measurements.

Conclusion

This study demonstrates that deep breathing exercises can significantly improve the respiratory health of petrol pump workers in Pune city. The pre-test results indicated poor respiratory status, likely due to prolonged exposure to petrol and diesel fumes, but after the intervention, the post-test results showed a remarkable improvement, with a substantial increase in respiratory function scores. Statistical analysis confirmed the intervention's high effectiveness, as evidenced by the significant difference between pre-test and post-test scores ($t = 22.59$, $p = 0.00001$). These findings highlight the potential of deep breathing exercises as a simple, cost-effective, and non-invasive method to enhance respiratory function among workers exposed to occupational hazards. The study emphasizes the importance of incorporating such workplace interventions to address respiratory health concerns, which can contribute to better overall health, reduce respiratory complications, and improve the well-being of workers in high-risk environments. Within the limitations of a one-group design and the respiratory status assessment used, the findings support exploring deep breathing exercises as part of workplace health education. Future research with a comparison group, objective lung function measurements, and a longer follow-up period would help determine the persistence and clinical importance of the observed improvements. The intervention should complement, rather than replace, occupational exposure reduction, appropriate protective measures, and medical assessment for workers with respiratory symptoms.

Declaration by Authors

Ethical Approval: The study was approved by the institutional ethics committee of Bharati Vidyapeeth (Deemed to be University), Pune. The study participants were briefed about the purpose and nature of the study and written informed consent was obtained before data collection.

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Conflict of Interest: The authors declare no conflict of interest.

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