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# The Effectiveness of Deep Breathing Exercise on Lung Expansion Rate in Patients with Respiratory Disorders using Chest Drains

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**ABSTRACT**

*A chest drain is a medical procedure performed to remove air, fluid, or blood that has accumulated in the pleural cavity, the space between the lungs and the chest wall, to maintain normal lung function. The insertion of a chest drain can cause partial lung collapse or atelectasis. One of the post-surgical care strategies for patients with chest drains is deep breathing exercise therapy. To evaluate the effectiveness of deep breathing exercises on the rate of lung expansion in patients with respiratory disorders using chest drains. This study employed a quasi-experimental design with a pre-test and post-test control group design. The sample consisted of 17 patients with chest drains, selected using total sampling. The measurement tool used was a Peak Flow Meter. Based on the Paired t-test and independent t-test results, the p-value was less than 0.05, indicating significance. The effectiveness test using Cohen's d effect size showed pre-test (1.0) and post-test (3.1) values greater than 0.8, indicating a large effect size. Deep breathing exercise therapy significantly and substantially affects lung expansion rate in patients with respiratory disorders using chest drains.*



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## 1. INTRODUCTION

Pleural disease affects up to 3000 people per million population each year in the UK, with a significant number requiring acute pleural intervention in hospitals. A 2010 national audit of 58 UK hospitals revealed an average of over seven chest drains per hospital per month [1]. A chest drain is a medical procedure performed to remove air, fluid, or blood that has accumulated in the pleural cavity, the space between the lungs and the chest wall. This invasive procedure is often essential to maintain normal lung function [2]. In the US, chest drains are required in over two million adults annually. Of the approximately 893 ICU patients requiring an invasive procedure in a year, 150 (16.7%) had a chest drain inserted. In the United Kingdom (UK), a single hospital had 375 children with chest drains inserted over six months. In Australia, approximately 25% of all major trauma patients admitted to trauma centers require a chest drain. Chest drain placement can result in partial lung collapse or atelectasis.

Atelectasis is a condition where part or all of the lung does not fully expand, resulting in reduced breathing capacity and inefficient gas exchange. This can hurt the patient's recovery and quality of life post-

operatively [3]. Post-operative care efforts for chest drain installation are one of the surgical procedures to maintain respiratory function. While the length of time needed to remove the chest drain depends on the patient's health condition, the longer the length of stay (LOS) can affect the quality of hospital services, the longer the inpatient length of stay (LOS) the higher the cost of services. Deep Breathing Exercises (DBE) or deep breathing exercises are techniques used in post-operative care to help accelerate lung development and improve respiratory function. However, the effectiveness of DBE in the context of chest drain installation is not fully understood [4]. At Prof. Dr. Margono Soekarjo Purwokerto Hospital, the number of inpatient visits with pleural effusion cases within a period of one year was approximately 119 patients.

In the Teratai room integrated surgical installation, the number of patients with chest drains installed in September 2023 was 17 patients (Medical Records, Margono Hospital, September 2023). Post-chest drain installation care in the lotus room has not been optimally carried out deep breathing exercises. The room has only maximally recorded production and vital signs of the recovery process of patients with chest drains. Regarding the problem of suboptimal service for chest drain patients, the formulation of the problem in this study is "How Effective is Deep Breathing Exercise on Lung Expansion Rate in Patients with Respiratory Disorders with Chest Drain?". The purpose of this study is to determine the Effectiveness of Deep Breathing Exercises on Lung Expansion Rate in Patients with Respiratory Disorders with Chest Drain.

## 2. RESEARCH METHOD

The study used a quasi-experimental design with a pre-test and post-test with a control group design approach in both research groups (intervention group and control group). This study was conducted at the Surgical Inpatient Installation of Prof. Dr. Margono Soekarjo Purwokerto Hospital and was carried out from April to May 2024 with 34 respondents who met the criteria in the study, namely patients with Chest drains ranging from 18-65 years old with a diagnosis of Emphysema, Haemothorax, Pleural effusion, Pneumothorax, Neoplasm of uncertain or unknown behavior: Connective, and other specified pleural conditions. The research instrument used by researcher used 4 instruments, namely the Standard Operating Procedure (SOP) for Deep breathing exercises, the Standard Operating Procedure (SOP) for the use of Peak Flow Meters, observation sheets for the effectiveness of Deep breathing exercises, and Peak Flow Meters as tools in collecting research data.

## 3. RESULTS AND DISCUSSIONS

### 3.1 Univariat

Based on **Table 1** above, it is known that most of the distribution frequency characteristics respondents in the group interventions , including age in group intervention dominated by the range age >40 years as many as 10 respondents (58.8%), the majority various sex man as many as 15 respondents (88.2%), with indication *traumatic pneumothorax* as many as 5 respondents (29.4%). Installation time *chest drain* majority for >1 week in 9 respondents (52.9%) and frequent cases found that is *medical surgical* as many as 13 respondents (76.5%). Distribution frequency characteristics respondents in the group control, including age in group control dominated by the range age >40 years as many as 9 respondents (52.9%), the majority various sex man as many as 9 respondents (52.9%), with indication *traumatic pneumothorax* as many as 5 respondents (29.4%). Installation time *chest drain* majority for <1 week in 12 respondents (70.6%) and frequent cases found that is *medical surgical* as many as 12 respondents (70.6%).

Based on **Figure 1** above, it is known that chart distribution frequency development lungs in groups intervention *pre-test* has *PEFR value* all in all in the red zone a total of 17 respondents (100%), and the results *post-test* shows Respondent own *PEFR value* is in the yellow zone a total of 17 respondents (100%). Chart frequency development lungs in groups control *pre-test* has *PEFR value* all in all in the red zone a total of 17 respondents (100%), the *post-test results* showed Respondent own *PEFR value* is in the yellow zone a total of 17 respondents (100%).

Based on **Table 2** it is known that homogeneity test results own mark Significance (Sig.) is greater big of 0.05 on all data, so the data can be concluded nature homogeneous.

Based on**Table 3**, it known that average PEFR value of the intervention group before DBE was introduced was 47.47 and after training it became 66.76. Then the average PEFR value of the control group without intervention was 44.06 and after training it became 55.59. The results of the *independent sample t-test* show p- value of 0.000 indicates existence significant difference between the average *PEFR values* Respondent in group intervention after given DBE and group control without given intervention whatever

Based on

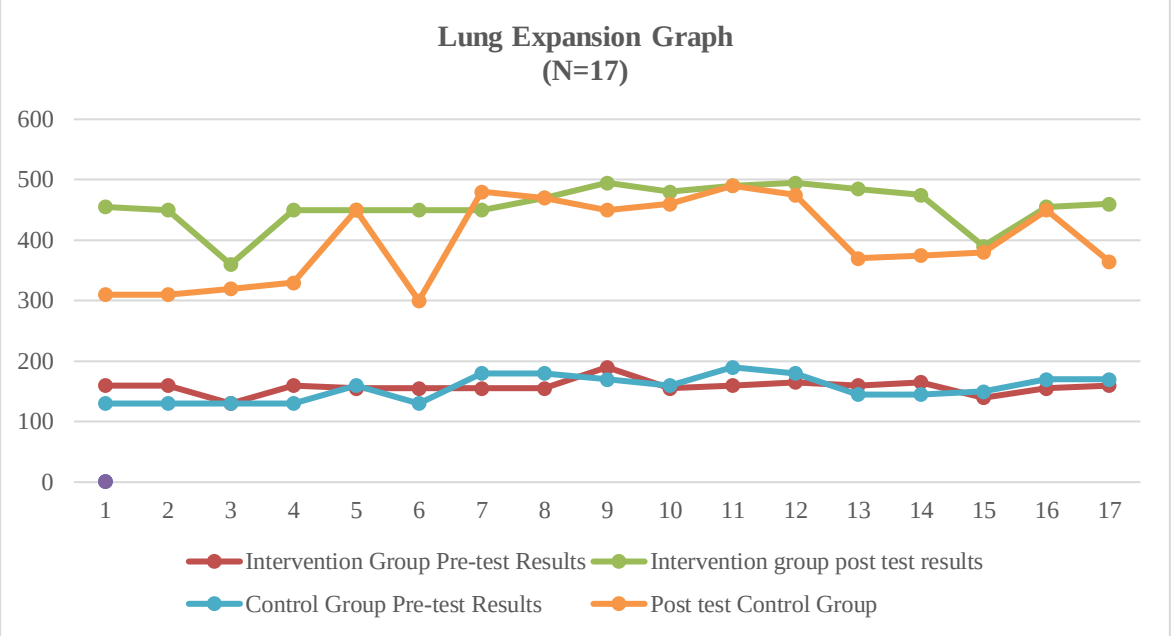
**Table 4**

**Table 4.**. The results of the data distribution for the *Cohen's d Paired T Test*, it known that results *Cohen's d effect size paired t test* with mark *effect size* on group intervention of 3.0 and the group control of 2.0. The results show that results effectiveness in research this own great effectiveness because more from 0.8.

**Table 1.** Frequency Distribution of respondent characteristics in the intervention group and control group (N=34)

| Variable | Group Intervention | | Group Control | |
|---|---|---|---|---|
| | F | % | F | % |
| **Age** | | | | |
| <25 years | 2 | 11.8 | 2 | 11.8 |
| 25-30 years | 4 | 23.5 | 4 | 23.5 |
| 31-35 years | 1 | 5.9 | 0 | 0 |
| 36-40 years | 0 | 0 | 2 | 11.8 |
| >40 years | 10 | 58.8 | 9 | 52.9 |
| **Gender** | | | | |
| Man | 15 | 88.2 | 9 | 52.9 |
| Woman | 2 | 11.8 | 8 | 47.1 |
| **Indication Installation** | | | | |
| Pneumothorax | 2 | 11.8 | 4 | 23.5 |
| Hemothorax | 3 | 17.6 | 1 | 5.9 |
| Aspergillosis | 2 | 11.8 | 0 | 0 |
| Emphysema | 1 | 5.9 | 3 | 17.6 |
| Pleural effusion | 3 | 17.6 | 4 | 23.5 |
| Pyothorax without fistula | 1 | 5.9 | 1 | 5.9 |
| Traumatic pneumothorax | 5 | 29.4 | 4 | 23.5 |
| **Installation Time *Chest Drain*** | | | | |
| <1 week | 8 | 47.1 | 12 | 70.6 |
| >1 week | 9 | 52.9 | 5 | 29.4 |
| ***Case*** | | | | |
| Traumatic | 5 | 29.4 | 4 | 23.5 |
| Medical Surgical | 12 | 70.6 | 13 | 76.5 |

**Figure 1.** Graph Development lungs in groups intervention and group control using PEFR value zones (n=17)




### 3.2. Bivariat

**Table 2.** Results of data distribution against homogeneity test

| Data | Sig | Results |
|---|---|---|
| Pre-Test *PEFR Values* in Intervention and Control Groups | 0, 137 | Homogeneous |
| Post Test *PEFR Values* in Intervention and Control Groups | 0, 169 | Homogeneous |

**Table 3.**. The results of data distribution for the *Paired T Test* in the intervention and control groups

| Variables | Group | N | Mean | Sig. (2-tailed) |
|---|---|---|---|---|
| *PEFR* Pre Value | Intervention | 17 | 47.47 | 0.003 |
| | Control | 17 | 4 6.06 | |
| *PEFR* Post Value | Intervention | 17 | 66.76 | 0,000 |
| | Control | 17 | 55.59 | |

**Table 4.**. The results of the data distribution for the *Cohen's d Paired T Test*

| Variables | Average | Std. Deviation | *Cohen's d* |
|---|---|---|---|
| *Pre -post* Intervention | -19,294 | 5,588 | -3,453 |
| *Pre- Post* Control | -11,529 | 4,862 | -2,315 |

**Table 5.**. The results of the data distribution for the *Cohen's d Paired T Test*

| Variables | Average | Std. Deviation | *Cohen's d* |
|---|---|---|---|
| *Pre -post* Intervention | -19,294 | 5,588 | -3,453 |
| *Pre- Post* Control | -11,529 | 4,862 | -2,315 |

Based on **Table 5** it known that results *Cohen's d effect size paired t test* with mark *effect size* on both *pre test* by 1.0 and on both *post test* of 3.1. The results show that results effectiveness in research This own great effectiveness Because more from 0.8.

## DISCUSSIONS

### Characteristics Respondents

Based on results study This range age more from 40 years is mature age in a way physical , spiritual and psychological . Age the is group age active in do activity daily especially in fulfil need life (Dewi & Fairuz, 2020) . Research result This show distribution frequency in group intervention majority aged >40 years as many as 10 respondents (58.8%), while in the group control majority aged >40 years as many as 9 respondents (52.9%). Research This own similarity with Dewi and Fairuz (2020) which is the majority. On age > 41 years , lung organs start experience setback like shrinking of lung size, loss of *elastic recoil* , body enlargement, changes in cell function, and less functional capillaries, which will inhibit diffusion function. This can affect the alveoli, decrease vital capacity, decrease PaO2 and residue, to failure functional lungs That Alone (Rosalina et al., 2019) Respondent his research aged more from 40 years as many as 106 people. Researchers other like dos Santos et al. (2020) also have the majority of respondents aged more from 40 years.

Research result This show majority various sex men, group intervention as many as 15 respondents (88.2%) and the group control as much as 9 respondents (52.9%). Research own similarity with Abuejheisheh et al. (2021) whose respondents majority man namely 119 people (75.3%). Researchers other like Dewi and Fairuz (2020) also have the majority of respondents man as many as 88 people (63.77%). System breathing man more need oxygen more Lots compared to Woman matter This due to difference vital capacity in men more big from women. Other factors like man more Lots do activities and many do activity so that tend consume oxygen more Lots (Rosalina et al., 2019). Research result show indication installation *chest drain* in cases of trauma or *medical surgical* If seen from diagnosis medical in group intervention and control majority is *traumatic pneumothorax*. These results own similarity with study Abuejheisheh et al. (2021) who have indication installation on one of the diagnosis that is *pneumothorax*. Diagnosis other like *hemothorax*, *emphysema*, and *pleural effusion* are also some of the characteristics in his research.

Research result indicates the characteristics of the old installation *chest drain* in group intervention majority for >1 week in 9 respondents (52.9%) and the group control majority for <1 week in 12 respondents

(70.6%). The results of the study This The same like study Agung et al. (2019) whose respondents own duration >7 days as many as 27 people (90%) and <7 days as many as 3 people (10%). Installation time *chest drain* adjustment condition as well as need lungs . This is done so as not to the occurrence complications or lungs experience collapse so that installation *chest drain* is a must adapt need lungs so they can back to optimal in term time certain Good during not enough or more from 1 week (Suryarinilsih et al., 2023). Research result This show common cases found is *medical surgical* in group intervention as many as 11 respondents (64.7%) and the group control as many as 12 respondents (70.6%). These results own similarity with study Abuejheisheh et al. (2021) who showed cases that occurred in his research namely *medical surgical.*

**_PEFR_ Value In Group Intervention Before and after given DBE**

This matter indicates existence difference average value between results *pre-test* and *post-test* on groups intervention as big as - 19,294 which can concluded that DBE training has significant impact in increase *PEFR value* respondents in the group intervention . This is reinforced with mark *p value* of 0.000 which shows significance statistics (less from 0.05). Based on explanation said , can concluded that exercise *deep breathing exercise* on patients with *chest drain* capable increase mark *PEFR* after given exercise said . The exercise done 6 times a day for 4 days with duration 1-5 minutes and can done in the morning or Afternoon or Evening. Study This own similarity with Santoso (2018) who showed existence difference significant between before and after patient given DBE interventions , namely with mark *p-value* (0.000). Santoso (2020) also explains that mark *PEFR* is influenced by factors including : age , type gender , history smoking . In the study

This majority Respondent various sex the man where be one of factors that influence mark *PEFR.* Research this and research The Greatest Showman (2018) own similarity Where majority the respondents various sex man. Data obtained in the group intervention in research this also has characteristics the majority of respondents the respondents have installation time *chest drain* > 1 week so that researcher conclude that existence severity of the condition lungs respondents in the group intervention . Improvement in value *PEFR* in groups intervention caused by the DBE training given and taught to Respondent For done every day for condition lungs get better.

**Difference in Mean _PEFR Values_ Between Groups Interventions and Groups Control**

This research result show results *pre test* , average *PEFR value* group intervention is 47.47 and the average in the group control is 46.06. The results of *the independent sample t-test* show p-value of 0.003 and the results This show existence significant difference between the average *PEFR values* Respondent in group intervention and group control before given DBE. Next data is results *post test* , average *PEFR value* in the group intervention after given DBE increased to 66.76 and the average *PEFR value* in the group control without given intervention whatever increase to 55.59. The results of the *independent sample t-test* show p- value of 0.000 indicates existence significant difference between the average *PEFR values* Respondent in group intervention after given DBE and group control without given intervention whatever. Research result own similarity with Mavkar and Shukla (2024) explain that existence difference significant results *pre test* and *post test* on both group.

Second group experience increase in value *PEFR,* however the difference between the two is in the group intervention experience improvement mark *PEFR* far more tall compared to group control. This is caused by the DBE therapy given help functional lungs improve , train lungs so that the condition stable and able Work optimally in periodically.

**Interpretation of _Cohen's d Effect Size_ Results**

Research result show *Cohen's d effect size paired t* test results with mark *effect size* on group intervention of 3.0. The results of the study This also shows the *Cohen's d effect size independent t* test with mark *effect size* on both *pre test* by 1.0 and on both *post test* of 3.1. The results of both tests show that results effectiveness in research This own great effectiveness Because more of 0.8 (National University, 2024) . *Cohen's d* has mark interpretation For determine big small the effects received include: (a) 0.2 = effect small; (b) 0.5 = effect currently; (c) 0.8 = effect big. Study This own similarity with Leelarungrayub et al. (2018) who have similarity that This DBE breathing therapy own effect on function lungs Good in a way development muscle up to individual *PEFR* with test result value *effect size* of 1.15 which means *deep breathing exercise* has an impact big on function lungs. This research own mark effect more from 0.8 and the value the has tested using 2 methods namely *paired t test* and *independent t test. The* results are show that therapy *deep breathing exercise* has effectiveness or impact both on the respondents who are installed *chest drain.*

## 4 CONCLUSIONS AND RECOMMENDATION

Based on the results and discussion in this study, There is change average speed value development lungs before and after Deep Breathing Exercise. Pre-test results second group is in the red zone and the results post-test

shows Respondent own PEFR value is in the yellow zone, when p-value <0.05 which indicates existence significant difference between the average PEFR values respondents on both group and effectiveness test results with Cohen's d effect size shows mark pre-test (1.0) and post-test (3.1) more big from 0.8 which means own effectiveness big. This intervention possible can produce results for more optimal if given more from 4 days or for 1 month. In addition, on the tool peak flow meter is difficult for searched in domicile and data retrieval only focus on value PEFR and not take data from respiratory rate saturation oxygen as well as disease comorbidities in patients.

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