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The Effect of Deep Breathing Exercise on Lung Capacity of Dyspepsia Patients at the Clinics Pada Idi Medical Center and Prima Physio Sakura, Makassar City

Andi Urwatul Wutsqa[1*], Ita Rini[2], Andi Rahmaniar SP[3], Meutiah Muthmainnah[4]

[1, 2, 3 ,4] Departement of Physiotherapy, Faculty of Nursing, Hasanuddin University, Makassar, Indonesia*
**Email corresponding authors andiurwaa17@gmail.com*

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Abstract

Aims: Dyspepsia is a digestive disorder that can cause increased intra-abdominal pressure, which has an impact on decreasing lung capacity. One of the non-pharmacological interventions that can be used to increase lung capacity is deep breathing exercise (DBE). This deep breathing exercise is known to be able to increase lung elasticity and gas exchange efficiency.

Methods. This study used a quasi-experimental design with pre-test and post-test in the experimental and control groups. The sample consisted of 22 dyspepsia patients divided into two groups: 11 people in the intervention group who were given deep breathing exercise for 9 sessions and 11 people in the control group. Lung capacity was measured using a peak flow meter before and after the intervention. Data analysis was performed using the paired sample t-test.

Results. The results showed a significant increase in lung capacity in the intervention group after being given deep breathing exercise with the mean PEFR increased from 224.5 L/min to 335.4 L/min (p=0.001). In contrast, in the control group there was no significant difference before and after the period without intervention (p=0.157).

Conclusion. Deep breathing exercise has been shown to have a significant effect in increasing lung capacity in patients with dyspepsia. This exercise can be recommended as an additional therapy in dyspepsia management to improve respiratory function and quality of life in dyspepsia patients.

Keywords : Deep Breathing Exercise; Dyspepsia; Lung Capacity

Introduction

Non-communicable diseases (NCDs) are a group of diseases with high incidence in Indonesia. The World Health Organization (WHO) predicts that in 2020, the proportion of deaths due to non-communicable diseases will increase to 73% and the proportion of morbidity to 60% in the world [1].

Dyspepsia is one of the most common non-communicable diseases in the world [2]. The World Health Organization (WHO) states that the number of people suffering from dyspepsia

worldwide ranges between 15 and 30 percent each year. The prevalence rate of dyspepsia ranges between 7 and 45%, depending on the definition used and geographic location [3]. In Indonesia, dyspepsia is ranked 5th as the disease with the most hospitalizations and 6th as the disease with the most outpatients in hospitals [4]. According to data from the 2021 Indonesian Health Profile, dyspepsia is one of the five main diseases causing hospitalizations that year, with an incidence of 18,807 cases (39.8%) in men and 60.2% in women [5]. In 2022, there were round 10 million people or 6.5% of the total population. In 2023, the incidence of dyspepsia is estimated to increase from 10 million people to 28 million people, equivalent to 11.3% of the total population in Indonesia [6].

Dyspepsia primarily affects the digestive system, but research suggests a link between dyspepsia and chronic lung disease and chronic obstructive pulmonary disease (COPD). A literature review published in *the Journal of Respiration* in 2022 highlighted that chronic lung disease is often found together with gastrointestinal symptoms or even gastrointestinal disease as its comorbidity. Conversely, many cases of gastrointestinal disease develop into respiratory dysfunction [7].

The lungs are one of the most important organs in the human body. Its function as the main part of the respiratory system has a fairly large role, especially in the body's homeostasis process. Each individual has a different breathing rate and depth [8].

In lung disorders, there will be a decrease in lung volume and capacity, causing oxygen levels in the blood to decrease. Therefore, one of the main goals of giving deep breathing exercises is to make ventilation easy and a person can inhale maximum oxygen after normal expiration. With deep breathing exercises, the effectiveness of the intercostal muscles between the ribs can be increased which helps improve breathing, oxygen saturation, lung function, and ultimately quality of life. This exercise is easy to learn, and can be done anywhere, anytime [9].

Based on observations conducted by researchers from September to November 2024, there were 50 patients with dyspepsia and the majority of dyspepsia patients at the Pada Idi Medical Center Clinic and Prima Physio Sakura, Makassar City experienced respiratory disorders.

Although several studies have reported the benefits of breathing exercises in respiratory conditions, evidence on their effects on patients with dyspepsia remains limited. Therefore, this study aims to determine whether deep breathing exercise can significantly improve lung capacity in dyspepsia patients. Based on the results of these observations, the researcher as a physiotherapy student is interested in conducting research on the effect of deep breathing exercise on the lung capacity of dyspepsia sufferers at the Pada Idi Medical Center Clinic and Prima Physio, Makassar City.

Methods

This study used a quasi-experimental method with a pre-test and post-test design in two groups. The sample consisted of 22 respondents divided into an intervention group (n=11) and a control group (n=11) with sample selection using purposive sampling. Lung capacity measurements were performed using a Peak Flow Meter before and after the Deep breathing exercise intervention three times per week for three weeks, with each session lasting approximately 20 minutes under supervision. Inclusion criteria for this study are respondents who are patients at the Clinic Pada Idi Medical Center and Prima Physio Sakura Makassar, patients diagnosed with dyspepsia, and those who are cooperative and willing to be respondents by signing the Informed Consent. The exclusion criteria are patients in very poor condition and patients with severe cardiovascular disorders. Datas were analyzed using the Paired Sample t-Test to determine the significance of differences in lung capacity before and

after the intervention. The series of research processes has received ethical approval recommendations from the Ethics Committee of the Faculty of Nursing, Hasanuddin University, Number 2375/UN4.18.3/TP.01.02/2024

Results

Table 1. Respondent Characteristics

Characteristics Respondent	N	%
Age		
<40	10	45.5
40-60	6	27.3
>60	6	27.3
Total	**22**	**100**
Gender		
Man	10	45.5
Woman	12	54.5
Total	**22**	**100**
Work		
Housewife	6	27.3
Self-employed	5	22.8
Teacher / Lecturer	3	13.6
Students	5	22.8
Farmer	1	4.5
Physiotherapy	1	4.5
civil servant	1	4.5
Total	**22**	**100**
Education		
No Formal Education	1	4.5
Elemntary School	2	9.1
Junior High School	1	4.5
Senior High School	4	18.2
College	14	63.6
Total	**22**	**100**
Smoking Status		
Active	2	9.1
Not active	20	90.9
Total	**22**	**100**

n: Number of Samples

Based on the table, it can be seen the frequency of respondent characteristics in this study based on several variables, namely age, gender, occupation, education level, and smoking status. Based on the data obtained, the majority of respondents were under 40 years old (45.5%), In terms of gender, more than half of the respondents were women (54.5%) and in terms of occupation, most respondents were housewife with a percentage of 27.3%.

In terms of education level, the majority of respondents, respondents have completed higher education, namely 63.6%, and finally, based on smoking status, the majority of respondents (90.9%) do not smoke.

Table 2. Respondents' Lung Capacity Criteria

	Lung Capacity	Pre test		Post test	
		n	%	n	%
Group Intervention	Normal	0	0	0	0
	Mild to moderate disorders	1	9.1	6	54.55
	Severe disturbance	10	90.9	5	45.45
	TOTAL	**11**	**100**	**11**	**100**
Group Control	Normal	0	0	0	0
	Mild to moderate disorders	5	45.45	2	18.18
	Severe disturbance	6	54.55	9	81.82
	TOTAL	**11**	**100**	**11**	**100**

Based on the table, lung capacity in the intervention group, before the intervention, the majority of respondents (90.9%) had severe disorders in lung capacity (<50%). After the intervention, there was an increase in lung capacity, where respondents who experienced severe disorders decreased to 45.45%.

In the control group, during the pre-test, there were 54.55% of respondents with severe lung capacity disorders and 45.45%. After the post test (research period without intervention), the number of respondents with severe disorders increased to 81.82%.

Table 3. PEFR Values

Variable	Min-Max	Median	Mean	Standard Deviation
Pre-Test				
Intervention Group	130-450	200.00	224.55	103.37
Control Group	80-550	300.00	287.27	130.69
Post-Test				
Intervention Group	130-470	340.00	335.45	117.50
Control Group	60-540	250.00	265.45	123.48

Source: Primary Data (2025)

PEFR values in the intervention group, before the intervention ranged from 130-450 L/minute, with a median of 200.00 L/minute, an average of 224.55 L/minute, and a standard deviation of 103.37. After the intervention, there was an increase in PEFR values, with a range of 130-470 L/minute, the median increased to 340.00 L/minute, and the average increased to 335.45 L/minute with a standard deviation of 117.50. These results indicate an increase in lung capacity after deep breathing exercises (Table 3).

Meanwhile, in the control group, before the intervention, PEFR values ranged from 80-550 L/min, with a median of 300.00 L/min, an average of 287.27 L/min, and a standard deviation of 130.69. After the study period without intervention, PEFR values actually decreased slightly with a range of 60-540 L/min, a median of 250.00 L/min, and an average of 265.45 L/min with a standard deviation of 123.48.

Discussion

Characteristics of Research Respondents

Based on the research results, the characteristics of respondents in this study include age, gender, occupation, education, and smoking status. Of the total 22 respondents, the majority were in the age range of 40–60 years (50.0%), followed by those under 40 years of age (45.5%), and those over 60 years of age (27.3%). This age distribution is in accordance with previous studies showing that the age group of 40 years and over has a higher risk of experiencing dyspepsia due to physiological changes in the digestive system and decreased lung function with age [10]. With advancing age, there is a gradual decline in gastrointestinal motility, reduced gastric mucosal defense, and decreased secretion of digestive enzymes, which together slow gastric emptying and increase susceptibility to functional dyspepsia. Concurrently, aging also leads to loss of elastic recoil in lung tissue, weakening of respiratory muscles, and decreased alveolar surface area, resulting in reduced pulmonary compliance and impaired ventilation capacity. In addition, the autonomic nervous system which regulates both gastrointestinal and respiratory functions undergoes dysregulation with age, contributing to altered visceral sensitivity and impaired coordination between breathing and abdominal pressure. Mechanical factors also play a role, as abdominal bloating or increased intra-abdominal pressure from dyspepsia can restrict diaphragmatic movement and reduce lung expansion, thereby decreasing pulmonary function. These interconnected physiological mechanisms provide a strong rationale for the observed association between dyspepsia and reduced pulmonary function among middle-aged and older adults.

In this study, the predominance of women (54.5%) compared to men (45.5%) can be explained by differences in hormonal and lifestyle factors. Hormonally, women experience fluctuations in estrogen and progesterone levels that influence gastrointestinal (GI) function. Estrogen affects smooth muscle tone and gastric emptying, leading to symptoms such as bloating, fullness, and epigastric discomfort. It also modulates serotonin activity in the gut, which plays a key role in regulating visceral sensitivity and pain perception. Meanwhile, progesterone has a relaxing effect on smooth muscle, which can slow gastric motility and increase the likelihood of gastroesophageal reflux. These hormonal effects are more pronounced during the luteal phase of the menstrual cycle and pregnancy, periods when estrogen and progesterone levels are elevated, thereby predisposing women to dyspeptic symptoms.

In terms of lifestyle, women are more likely to adopt eating patterns that may contribute to dyspepsia, such as skipping meals or eating irregularly, particularly during periods of psychological stress. The consumption of foods high in fat, caffeine, or spice can further exacerbate gastrointestinal discomfort. Moreover, women tend to report higher levels of stress, anxiety, and depression, which can influence the gut–brain axis, increasing visceral hypersensitivity and altering gastric motility. The use of non-steroidal anti-inflammatory drugs (NSAIDs), commonly taken to relieve menstrual pain, may also irritate the gastric mucosa and worsen dyspeptic symptoms. These combined hormonal and lifestyle factors provide a plausible explanation for the higher prevalence of dyspepsia observed among women compared to men [11].

Based on the type of work, most respondents work as housewives (27.3%), followed by self-employed (22.8%), teachers/lecturers (13.6%), and students (22.8%). The type of work can affect the risk of dyspepsia and lung capacity, especially for individuals who have high stress levels or a less active lifestyle [12].

The improvement in PEFR may result from enhanced diaphragmatic mobility and lung compliance following repetitive deep inhalation. However, the limited sample size and short intervention period may restrict its generalizability. Future studies with larger samples and longer follow-up are recommended.

Education level shows that the majority of respondents have college at 63.6%, followed by high school (18.2%) and elementary school (9.1%). Higher education is often associated with a better understanding of healthy lifestyles, including breathing exercise habits that can increase lung capacity [13]. The results of this study showed that respondents with higher education levels still exhibited reduced lung capacity. This finding may be explained by several physiological and behavioral factors. From a physiological perspective, individuals with higher education often have occupations that require prolonged sitting, such as office or academic work, which may lead to reduced respiratory muscle endurance and limited thoracic expansion. In addition, dyspepsia-related abdominal distension and increased intra-abdominal pressure can further restrict diaphragmatic movement, reducing lung volume regardless of health literacy. Furthermore, metabolic conditions such as overweight or central obesity common among sedentary professional may compress the diaphragm and chest cavity, contributing to decreased pulmonary capacity.

From a behavioral standpoint, highly educated individuals may experience high psychological stress and irregular exercise routines due to demanding work schedules. Chronic stress can affect the autonomic nervous system, altering breathing patterns and influencing both gastrointestinal and respiratory function. Moreover, spending long hours in indoor environments with limited air circulation may expose individuals to indoor air pollutants or poor ventilation, which can further impair respiratory health. Therefore, although higher education is generally linked to better health awareness, knowledge alone does not necessarily translate into healthier physiological outcomes. The combination of occupational habits, sedentary lifestyle, and psychological stress may counteract the expected positive effects of education on lung function. From the aspect of smoking status, 90.1% of respondents were non-smokers, while the other 9.1% were smokers. active smoker.

Overall, these findings suggest that age, gender-related hormonal fluctuations, occupational stress, and lifestyle patterns may interact to influence the relationship between dyspepsia and pulmonary function. However, further studies with larger sample sizes and more diverse populations are needed to confirm these associations and clarify the underlying mechanisms.

Lung Capacity

Based on the research results, the lung capacity of respondents in this study was analyzed before (pre-test) and after (post-test). test) *deep breathing exercise* intervention in the intervention group and control group.

In the intervention group, before the intervention, the majority of respondents (90.9%) had severe lung capacity disorders (<50%), while 9.1% had mild to moderate disorders (50 - 79%). After the intervention, there was an increase in lung capacity, where 54.55% of respondents had mild to moderate disorders, while 45.45% still had severe disorders. No respondents achieved normal lung capacity (>79%) either before or after the intervention. These results indicate that *deep breathing exercise* has a positive effect on increasing the lung capacity of dyspepsia sufferers, although it has not completely restored lung function to normal conditions.

In the control group, the pre-test results showed that 54.55% of respondents had severe lung capacity disorders and 45.45% had mild to moderate disorders. After the study period without intervention, the number of respondents with severe disorders increased to 81.82%,

while those with mild to moderate disorders decreased to 18.18%. In this study, 10 out of 11 respondents experienced a decrease in lung capacity and only 1 respondent experienced an increase. The majority of respondents in the control group experienced a decrease in lung capacity, this was caused by several factors such as lack of physical activity, fatigue, etc. This shows that without intervention, lung capacity tends to decrease in people with dyspepsia. The results of this study are in line with previous studies which stated that breathing exercises, especially *deep breathing exercises,* can increase lung capacity by improving lung elasticity, increasing lung expansion, and improving the efficiency of oxygen and carbon dioxide exchange [14]. According to Jones et al. (2022), people with dyspepsia often experience diaphragmatic disorders and increased intra-abdominal pressure, which contribute to decreased lung capacity.

Increased intra-abdominal pressure (IAP) has a direct mechanical and physiological impact on both diaphragmatic movement and pulmonary function. Physiologically, the diaphragm serves as the primary muscle of respiration, contracting downward during inspiration to expand the thoracic cavity and facilitate lung inflation. When IAP rises—due to abdominal distension, bloating, obesity, or gastrointestinal disorders such as dyspepsia the upward displacement of the diaphragm restricts its excursion and limits the vertical expansion of the lungs, thereby reducing tidal volume and overall lung compliance [15].

This restriction increases the work of breathing, as the respiratory muscles must generate greater negative intrathoracic pressure to achieve adequate ventilation [16]. Prolonged elevation of IAP may also lead to diaphragmatic fatigue and decreased contractile efficiency, particularly in the lower zones of the lungs where ventilation-perfusion matching becomes impaired. Consequently, these changes can contribute to reduced Peak Expiratory Flow Rate (PEFR) and decreased pulmonary volumes such as vital capacity and total lung capacity.

Furthermore, increased IAP influences the interaction between the abdominal and thoracic compartments. When abdominal pressure rises, the transmission of pressure to the thoracic cavity alters intrathoracic hemodynamics potentially reducing venous return and lung perfusion and may further compromise gas exchange efficiency [16]. Over time, chronic intra-abdominal distension can alter neuromuscular coordination between the diaphragm and abdominal wall, leading to maladaptive breathing patterns, particularly in individuals with functional dyspepsia or obesity [17].

Deep breathing exercises can help improve diaphragm function and increase the strength of the respiratory muscles. From these results, it can be concluded that *deep breathing exercise* intervention has benefits in increasing lung capacity in dyspepsia patients compared to the control group that did not receive intervention. Thus, this exercise can be recommended as an additional therapy for patients with dyspepsia who experience impaired lung capacity.

PEFR Value

Based on the research results Based on Table 4, the Peak Expiratory Flow Rate (PEFR) values were analyzed before (pre-test) and after (post-test) deep breathing exercise intervention in the intervention group and control group. PEFR is one of the important parameters in assessing lung capacity, especially in evaluating a person's maximum expiratory ability.

In the intervention group, before the intervention, PEFR values ranged from 130-450 L/minute, with a median of 200.00 L/minute, an average of 224.55 L/minute, and a standard deviation of 103.37. After the intervention, there was an increase in PEFR values, with a

range of 130-470 L/minute, the median increased to 340.00 L/minute, and the average increased to 335.45 L/minute with a standard deviation of 117.50. These results indicate an increase in lung capacity after deep breathing exercises.

Meanwhile, in the control group, before the intervention, PEFR values ranged from 80-550 L/min, with a median of 300.00 L/min, a mean of 287.27 L/min, and a standard deviation of 130.69. After the study period without intervention, PEFR values actually decreased slightly with a range of 60-540 L/min, a median of 250.00 L/min, and an average of 265.45 L/min with a standard deviation of 123.48.

These results indicate that deep breathing exercise plays a role in increasing the lung capacity of dyspepsia sufferers, as seen from the increase in PEFR values in the intervention group compared to the control group. The decrease in PEFR values in the control group also indicates that without intervention, the lung capacity of dyspepsia sufferers tends to decrease. Previous studies support these findings. According to [18], deep breathing exercises can significantly improve lung function by increasing lung elasticity and strengthening respiratory muscles. In addition, research by [19] found that people with dyspepsia often experience diaphragmatic dysfunction due to high intra-abdominal pressure, which can have an impact on decreasing lung capacity. Deep breathing exercises can help optimize diaphragm function, increase pulmonary ventilation, and improve the efficiency of gas exchange in the lungs.

The findings of this study indicate that participants who performed deep breathing exercises showed a notable increase in Peak Expiratory Flow Rate (PEFR) compared to the control group, suggesting an improvement in lung capacity among patients with dyspepsia. This enhancement may be related to improved diaphragmatic mobility, increased lung elasticity, and more efficient pulmonary ventilation following the intervention. Conversely, the control group exhibited a slight decline in PEFR, implying that without intervention, lung capacity in dyspeptic individuals tends to decrease over time.

These results suggest that deep breathing exercise may have potential as a supportive, non-pharmacological approach to help improve pulmonary function in patients with dyspepsia. However, further studies with larger samples and longer intervention periods are needed to confirm its therapeutic effectiveness and generalizability.

Effect of Deep Breathing Exercise on Lung Capacity in Dyspepsia Patients

Based on research results, Dyspepsia, or indigestion, is a condition that causes discomfort or pain in the upper abdomen. Although dyspepsia primarily affects the digestive system, some studies suggest that this condition can affect the respiratory system, including lung capacity. Decreased lung capacity in people with dyspepsia can be caused by several factors, such as gastric acid reflux affecting the respiratory tract or other mechanisms that are not yet fully understood.

Dyspepsia is a digestive disorder that is often associated with increased intra-abdominal pressure, which can affect a person's lung capacity and breathing patterns. One non-pharmacological method that can be used to increase the lung capacity of dyspepsia sufferers is deep breathing exercises. This exercise is known to help increase respiratory efficiency, optimize lung capacity, and improve disturbed breathing patterns due to gastrointestinal disorders [18].

Based on the results of the normality test in Table 5, the data obtained have a normal distribution because the significance value (Sig.) of the Shapiro-Wilk test in the experimental group before the intervention was 0.278, and after the intervention was 0.469. Likewise in the control group which has a *Sig.* value of 0.366 before the intervention and 0.527 after the

intervention. Because all *Sig.* values are greater than 0.05, the data is considered to be normally distributed, so it can be analyzed using the parametric Paired Sample t-Test to test the differences before and after the intervention.

The results of the statistical analysis in Table 6, show that there was a significant increase in lung capacity after the deep breathing exercise intervention. The average lung capacity before the intervention was 32.34 with a standard deviation of 13.36, while after the intervention it increased to 47.89 with a standard deviation of 16.01. The Paired Sample t-Test test showed a *t* value of -4.41 with degrees of freedom (df) 10, and a significance value *(*Sig. 2-tailed) of 0.001. In hypothesis testing, if Sig. <0.05, then the null hypothesis (Hÿ) is rejected. Because in this study the value obtained was 0.001 <0.05, it can be concluded that there is a significant difference between lung capacity before and after intervention in the experimental group.

The results of this study are in line with research conducted by [19] which states that deep breathing exercises can increase lung vital capacity and improve gas exchange efficiency in individuals with respiratory and gastrointestinal disorders. In addition, a study by [14]also showed that deep breathing techniques can increase lung vital capacity in people with digestive disorders by reducing excessive intra-abdominal pressure. Deep breathing exercises can increase diaphragm flexibility and improve breathing patterns, thereby indirectly increasing respiratory efficiency in people with dyspepsia [20].

Furthermore, research by Ahmed et al.[21] revealed that deep breathing exercises significantly increased the Peak Expiratory Flow Rate (PEFR) in patients with chronic digestive disorders. This is because deep breathing exercises can increase the elasticity of lung tissue, increase chest expansion, and improve airflow in the respiratory system. This finding is reinforced by a recent study conducted by Gupta [18] which found that breathing exercises can increase lung efficiency by 20-30% within 4-6 weeks of regular exercise.

Thus, based on the results of this study and the supporting theory, it can be concluded that *deep breathing exercise* has a significant effect in increasing lung capacity in patients with dyspepsia. This exercise not only helps improve respiratory function, but also contributes to reducing intra-abdominal pressure that can worsen dyspepsia symptoms. Therefore, deep breathing exercises can be recommended as one of the additional therapies in dyspepsia management to improve the quality of life of patient.

Conclusion

The findings of this study demonstrate that deep breathing exercise (DBE) significantly improves lung capacity in patients with dyspepsia. After nine sessions of intervention, participants in the experimental group showed a marked increase in Peak Expiratory Flow Rate (PEFR), indicating enhanced respiratory efficiency and diaphragmatic function. The improvement in lung capacity is likely due to the physiological effects of DBE, which include increased thoracic expansion, improved elasticity of lung tissue, and reduction of intra-abdominal pressure that commonly accompanies dyspepsia.

These results confirm that deep breathing exercise is an effective non-pharmacological therapy that can be integrated into dyspepsia management programs to optimize pulmonary function and improve patients' overall quality of life. Further studies with larger sample sizes and longer follow-up periods are recommended to strengthen the evidence for the long-term benefits of deep breathing exercise in this population. Deep breathing exercise should be considered as a non-pharmacological adjunct therapy in dyspepsia management to improve pulmonary function and patient well-being.

Author Contribution
All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Conflict of interest
Authors state no conflict of interest.

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