Effect of Alternate Nostril Breathing Exercise versus Diaphragmatic Breathing Exercise on Dyspnea and Fatigue among Asthmatic Patients

Aziza Ibrahim Abd El Kader[1], Fayza Ahmed Ibrahim[2], Eman Abd-Elrahman Mohamed[3]

[1&2] Lecturer of Medical Surgical Nursing, Faculty of Nursing, Cairo University.
[3]Lecturer of Medical Surgical Nursing, Faculty of Nursing, Mansoura University.

Abstract

Background: Dyspnea and fatigue are common symptoms among participants with asthma, significantly affecting their overall well-being. Breathing exercises, such as alternate nostril breathing and diaphragmatic breathing have gained popularity as complementary approaches to managing these symptoms. **Aim:** To evaluate the effect of alternate nostril breathing exercise versus diaphragmatic breathing exercise on dyspnea and fatigue among asthmatic patients. **Design:** A quasi-experimental research design with pre- and post-test was employed for this study. **Setting:** The study was conducted at the chest inpatient department and outpatient clinic of Cairo University Hospital. **Sampling:** A purposive sample of 60 participants with severe asthma, were randomly assigned to either group (1) that received alternate nostril breathing exercise or group (2) that received diaphragmatic breathing exercise. **Tools**: Three tools were used: (1)Participants' socio-demographic and medical related data, (II)Arabic version of the dyspnea-12 questionnaire, and (III)Arabic version of the brief fatigue inventory scale. **Results**: Post intervention, the total mean score of dyspnea in group 1and group 2 significantly decreased to(22.7±4.8;20.4±5.3)respectively compared to (33.0±3.3;33.9±4.7)respectively pre intervention. There was statistically significant difference in total mean score of fatigue(p=0.000**)pre and post intervention for both studied groups. Moreover, post intervention, there was no statistically significant difference between group 1 and group 2in dyspnea total mean score (p=0.090), while there was statistically significant difference between group 1 and group 2 in fatigue total mean score (p=0.005*). **Conclusion:** Both alternate nostril breathing and diaphragmatic breathing exercises can effectively improve dyspnea and fatigue among asthmatic participants, while, diaphragmatic breathing exercise demonstrated a superior effect on reducing fatigue compared to alternate nostril breathing exercise. **Recommendations:** Incorporating breathing exercises into the management of asthma could offer a non-pharmacological approach to alleviate dyspnea and fatigue, moreover, enhance participants' quality of life.

Keywords: Alternate Nostril Breathing, Asthma, Diaphragmatic Breathing, Dyspnea, Fatigue.

Introduction

Asthma is a chronic respiratory disorder characterized by persistent inflammation in the airways, giving rise to recurring episodes of wheezing, shortness of breath, coughing, and chest tightness, in association with expiratory airway obstruction (**Bereda, 2022; Kwon, et al., 2021**). Airway obstruction is primarily attributed to four key mechanisms: narrowing of bronchial smooth muscles, the airway wall edema, mucous plugging of bronchioles, and irreversible pulmonary alterations (**Santino, Chaves, Freitas, Fregonezi, &Mendonca, 2021**).

Dyspnea, a prominent symptom of asthma, ranks among the most debilitating symptoms. Patients describe it as an unpleasant sensation, frequently accompanied by several symptoms such as chest tension and difficulty breathing in and out. Furthermore, dyspnea leads to activity limitations and significantly impairs quality of life (**Cavalcanti, et al., 2022; Harper, &Trayer, 2022**). Fatigue also worsens as dyspnea severity increases, impacting patients' physical, social, and mental well-being, and restricting their ability to perform daily tasks such as household chores and self-care activities like bathing and dressing (**Andreasson, 2022; Günaydın, Ediger, &Erbay, 2021**).

Breathing exercises can enhance lung function and aid in breathing retraining, while others strengthen respiratory muscles and enhance rib cage flexibility (**Bacon, &Platts-Mills, 2020**).Diaphragmatic breathing (DB) is a beneficial exercise for both respiration and lung relaxation as it promotes efficient oxygen and carbon dioxide exchange. Also, it is reportedly efficient in improving ventilation efficiency, reducing dyspnea, enhancing activity capacity, and alleviating metabolic acidosis (**Aziz, Awad, Osman, & Elkholy, 2022**).

There are different types of breathing techniques that are principally helpful for asthmatics. Some of these exercises facilitate with breathing retraining; the other increases the strength of respiratory muscles and improves the flexibility of the rib cage (**Abd Elmawla, Zahran, &Elsaid, 2023**). Diaphragmatic breathing is a superior exercise for lungs relaxation and respiration because it enables adequate exchange of oxygen and carbon dioxide. It is reported to be successful in enhancement of ventilation competence, dyspnea, and activity capacity and decrease of metabolic acidosis (**Tran, Aly, Shah, Phu, &Malvankar-Mehta, 2023**).

Alternate nostril breathing (ANB) is a popular breathing exercise technique that involves alternating between inhaling and exhaling through one nostril while the other nostril is closed. This practice has been shown to improve lung capacity and breathing control. The natural nasal cycle involves alternating periods of congestion and decongestion in each nostril, influenced by the balance between the parasympathetic and sympathetic nervous systems (**Udaykumar, Ukkirapandian, Selvaraj, &Kannan, 2021**).

Dyspnea and fatigue are the most distressing symptoms of asthma, contribute to physical inactivity and a reduced quality of life (**Tyler, &Bunyavanich, 2019**). Nurses are vital part of the health care workers for asthmatic patients, and they should have the skills to care for them and reduce their symptoms. Generally, conventional medications reduce dyspnea and fatigue in these patients. However, long-term use of these drugs, has significant side effects that impact the quality of life of asthmatic patients.

Nurses can incorporate non-pharmacological interventions to reduce dyspnea and fatigue in asthmatic patients. Both Alternate Nostril Breathing and diaphragmatic breathing exercise is a non-invasive, convenient, simple and economical option that needs to be evaluated and tested (**Coulson, Carpenter, Georgia, & Baptist, 2022**).Therefore the current study seeks to compare the effectiveness of ANB versus DB exercise in alleviating dyspnea and fatigue in asthmatic

patients, aiming to provide means of managing these symptoms.

Significance of the Study:

Asthma is a potentially life-threatening chronic condition that imposes a considerable financial and social burden on individuals, their families, and society. It manifests with respiratory symptoms, activity limitations, and occasional flare-ups (attacks) that may require immediate medical attention and can be fatal (**Enilari, &Sinha, 2019**). Asthma is a widespread disease that affects people of all ages. An estimated 100 to 150 million people worldwide suffer from asthma. The disease is more prevalent in developed nations, making it a significant public health concern (**Caminati, et al., 2021**).In Egypt the prevalence of asthma is estimated to be around 6.7% of the general population (**Hosny, et al., 2022**).

Furthermore, the World Health Organization has acknowledged asthma as a widespread health concern, impacting both men and women with similar frequency. While asthma cannot be definitively eradicated, its clinical episodes can be effectively prevented and managed through appropriate interventions (**Ahmed, Ibrahim, Hassan, & Abd-El-Azem, 2022**). Asthma is a major contributor to the burden of respiratory diseases in Egypt. It is a leading cause of hospitalizations and chest department visits, and it can also lead to chronic disability and death. Asthma also has a significant economic impact on Egypt. The costs of asthma care, including medications, hospitalizations, and lost productivity, are estimated to be billions of Egyptian pounds each year.

The practice of ANB and DB exercises promotes voluntary control over breathing, leading to rhythmic respiration and mental calmness. These exercises effectively reduce stress, enhance relaxation, boost energy levels and vitality, and contribute to overall health and well-being (**Jahan, et al., 2021**).Alternate nostril breathing and diaphragmatic breathing exercises are simple, safe and convenient breathing exercise that can be practiced anywhere, anytime.

The current study has important implications for management of asthma. It suggest that, ANB and DB exercises may be effective way to reduce dyspnea symptoms and fatigue level and improve pulmonary function in asthmatic participants. Moreover, the findings of the current study will document which exercise has the superior effect on dyspnea and fatigue. By addressing these findings asthmatic participants can reduce reliance on medication, therefore, the burden of asthma on the healthcare system and the economy will decrease.

Aim of the Study:

The current study aimed to evaluate the effect of alternate nostril breathing versus diaphragmatic breathing exercise on dyspnea and fatigue among asthmatic patients.

The following three research hypotheses were formulated to achieve the current study aims:

H_1: There is a significant difference in dyspnea & fatigue severity score among alternate nostril breathing exercise group pre and post intervention.

H_2: There is a significant difference in dyspnea & fatigue severity score among diaphragmatic breathing exercise group pre and post intervention.

H_3: There is a significant difference in dyspnea & fatigue severity score between alternate nostril breathing group and diaphragmatic breathing group post intervention.

Sample and methods:

Research Design:

The researchers used pre-posttest quasi-experimental research design to achieve the aim of the current study. A quasi-experimental design enables the researchers to compare the pre-intervention and post-intervention measures to see if there is a change in the dependent variable (**Maciejewski, 2020**).

Setting:

The current study was carried out at the chest inpatient department and chest outpatient clinic at Cairo University Hospital. Inpatient chest department has a capacity of thirty-five beds for female patients, and twenty-six beds for males. This hospital offers non-paid public services for all governorates in Egypt.

Samples:

A purposive sample composed of 60 asthmatic participants were chosen for the study. Participants were eligible for the study if they met the following criteria: they were adult between 20 and 60 years old, diagnosed with severe asthma from both gender with different educational level, they were able to communicate effectively, and they did not have any other respiratory conditions that could cause fatigue such as pneumonia, anemia, heart disease, musculoskeletal disorders, or neurological disorders. Participants who have total fatigue severity mean score≥7 on Brief Fatigue Inventory scale and total dyspnea severity mean score ≥ 2on Arabic version of the dyspnea-12 questionnaire were included in this study. Participants were divided into two equal groups of 30 participants for each, that were assigned randomly and alternately, Group (1) received ANB exercise, while group (2) received DB exercise.

Sample size:

The Epi info7 software was used to determine the sample size based on the following criteria: the total number of patients at the hospital in the previous year was 289, the expected frequency of severe bronchial asthma was 50%, the acceptable margin of error was 10%, and the confidence level was 95%.

Tools of data collection:

The researchers used three tools for data collection:

Tool (I): Participants'socio-demographic characteristics and medical relateddata:

The researchers designed this tool based on related literature (**Hamad, et al.2023; Bereda, 2022; Hashem, &Yakout, 2020**) to assess participants' socio-demographic characteristics and medical related data includes 9 items regarding age, gender, education, marital status, occupation, area of residence, smoking habit, duration of asthma, and co-morbid diseases.

Tool (II): Arabic version of the dyspnea-12 questionnaire (D-12):

The researchers adopted this tool from (**Alyami, Jenkins, Lababidi, & Hill, 2015**). It was employed to assess the quality of

dyspnea symptoms, its severity and the emotional response. This questionnaire included 12 items, divided into two subdomains: physical and affective. The physical subdomain (items 1-7) assess the quality of dyspnea symptoms and its severity which contains the following: participant's (can't take a full breath, breathing requires more effort, feel short of breath, have difficulty catching his/her breath, can't get enough air, have uncomfortable breathing, have labored breathing).While the affective subdomain (items 8-12) used to evaluates the participant' emotional response to these breathing symptoms which includes the following: participant' feel (depressed, miserable, annoyed, agitated), in addition to the breathing is troublesome.

Scoring system:

Each item is rated on a 4-point scale (0 = no dyspnea, 1 = mild dyspnea, 2 = moderate dyspnea, and 3 = severe dyspnea). The total score ranges from 0 to 36, with subdomain scores ranging from 0 to 21 (physical) and 0 to 15 (affective). The total mean score of the Arabic D-12 questionnaire ranges from 0 to 3, with higher scores indicating greater dyspnea severity. A mean score below 1 indicates mild dyspnea, a mean score between 1 and 2 indicates moderate dyspnea, and a mean score of 2 or higher indicates severe dyspnea.

Tool (III): Arabic version of the Brief Fatigue Inventory (BFI) scale:

The researchers adopted this tool from (**Suleiman, et al., 2019**) to measure fatigue level among participants. It includes 9- items, the first three items addresses the participant's description of the current level of fatigue, the usual level of fatigue during the past 24 hours, and the worst level of fatigue during the past 24 hours. While, the next six items describe the effect of fatigue on participant' daily life during the past 24 hours in various areas including: general activity, walking, mood, regular work, relationships, and life enjoyment.

Scoring system:

Each item on the BFI is rated on a scale from 0 to 10, with 0 for no fatigue and 10 representing worst fatigue imaginable. The total score of the BFI is calculated by averaging the scores of all 9 items. A total score of (0 - <4) demonstrating “mild fatigue”, (4- <7) indicating “moderate fatigue” and (7-10) for “severe fatigue”.

Content Validity and Reliability:

Five experts from medical-surgical nursing, medical biostatistics, and in addition to chest diseases specialist reviewed the study tools to assess their content validity. The experts evaluated the tools content for clarity, relevancy, comprehensiveness, and applicability. Modifications were made accordingly. In addition, Cronbach's alpha standards were calculated to estimate the internal consistency of the study tools. The Arabic version of the dyspnea-12 questionnaire has a Cronbach's alpha of 0.80, while the Arabic version of the Brief Fatigue Inventory (BFI) scale had a Cronbach's alpha of 0.760.

Before data collection, the researchers carried out the pilot study on 10% of participants (six patients) to evaluate clarity, and applicability of the developed tool and make any necessary modifications before conducting the main study, as well as to estimate the required

time needed for completing the questionnaire. Participants included in the pilot study were excluded from the target sample size sample.

Ethical Considerations:

The researchers obtained the approval of the Ethical Committee for scientific research from the Faculty of Nursing, Cairo University, Egypt (**IRP: Ref. code 2022-28)**, and permission was granted by hospital administrator prior to conducting the study. Participants were informed about the study's purpose and their right to decline or withdraw from participation without penalty.

Field work &Data Collection

Data was collected through 7 months from December, 2022 until July, 2023. Fieldwork is accomplished through the following four phases:

I. Preparatory /Assessment phase

In this phase, before data collection the researchers got a written approval from the relevant authorities to conduct the current study. Afterward, the researchers prepared the tools for data collection, tool (I) was developed by the researchers after an extensive review of recent literature, then the final English version of the tool was translated into Arabic then back to English (back translation) and tested for content validity and reliability. Following that, the final Arabic version of the tool was prepared for collection of data, in addition to the adopted Arabic version of tools (II&III). After identifying eligible participants, individual interviews were conducted to gather data. At the outset of each interview, the study's purpose, nature, and tools were explained to the participants.

Consequently, written consent was obtained from all participants who met the inclusion criteria and decided to take part in the current study. The feasibility of implementing ANB and DB exercises for the current study was assessed by gathering data on the availability of samples and the appropriate tools, the suitability of the environment and facilities. Afterward, each participant in both ANB and DB exercise groups who conducted an initial assessment was individually approached by the researchers. This assessment included demographic and medical related data using tool (I), and dyspnea and fatigue severity using tools (II & III). The assessment session took 20-30 minutes for each participant.

II: Planning phase:

Based on initial data collection, the researchers considered the pre-test data in relation to participant' clinical related data. Moreover, ANB/DB breathing exercise techniques videos and hand out in simple Arabic form based on a review of recent literature were prepared by the researchers to support participants in implementing each technique (**Astuti&Huriah, 2022; Kanorewala&Suryawanshi, 2022**).

III: Implementation phase (implementing ANB/ DB exercise).

Individualized training sessions were conducted with each participant, alternating between ANB and DB groups. Both exercises were performed three times daily for four weeks. Participants were instructed to sit in a comfortable and upright position, maintaining a calm and quiet environment during intervention. The researchers provided the following detailed instructions for practicing alternate nostril breathing exercise for study group (1) followed by a practice session.

Participants were instructed to close their left nostril by left index finger and inhale through their right nostril for six seconds, then closing the right nostril and holding breath for six seconds. Afterward, they exhaled through the left nostril slowly for six seconds. Next, they inhaled through left nostril, keeping the right nostril closed for six seconds then hold the breath by closing both nostrils for six seconds subsequently, and then exhaled through the right nostril, keeping the left closed for six seconds repeating these steps several times for 10 minutes (**Jahan, et al., 2021**).

Concerning DB exercise, the researchers provided the following detailed instructions for the study group (2) followed by a practice session. Participants were educated to lie down on a comfortable, flat surface and relax shoulders, shifting them downward away from the ears, and then, they instructed to put one hand on chest and the other hand on stomach and breathe in through nose until they can't take in anymore air expanding stomach and sides of the waist. After that, chest remains moderately immobile then purse lips as if sipping throughout a straw, then exhale gradually through the lips for 4 seconds and feel the stomach softly contracting. Repeating these steps numerous times for 10 minutes (**Amola, Pawara, &Kalra, 2019**).

IV: Evaluation phase:

The effect of implementing ANB versus DB exercise on dyspnea and fatigue among asthmatic patients was evaluated by the researchers after 4 weeks from the initial assessment in chest outpatient clinic during the follow up visit using tools II, and III.

Data Analysis:

The study used Statistical Package for the Social Sciences version 20 (SPSS-v20) software to analyze the data. Descriptive statistics were calculated to describe participants' demographic and medical information using percentages, means, and standard deviations. To check if the two groups were similar at the beginning of the study, independent t-tests and chi-square tests were carried out. Independent t-tests were also used to compare dyspnea and fatigue scores within and between groups. A p-value of less than 0.05 was considered statistically significant.

Results:

Table (1): Shows that the mean age of the participants for group (1) and group (2) was (46.46 ± 11.86 ; 46.23± 12.83) with the high percent (70%, 76.7%) respectively aged between 40 - 60 years old. Regarding gender, marital status, educational level, occupation and place of residence, it was found that the high percent of the participants in group (1) and group (2) were female; married; able to read and write; not working and live in urban areas (60% & 70%; 60% &73.4%; 60% & 56.7%; 80% & 66.7%; 83.3% & 66.7%) respectively.

Concerning duration of asthma, 40% of group (1) is suffering from asthma for one to less than five years, while 40% of group (2) is suffering from asthma for more than five years. The high percent (60% & 70%) among participants (1) and group (2) respectively were non -smokers. Moreover, there were no statistically significant differences between group (1) and group (2) regarding socio- demographic and medical related data variables.

Fig (1): Illustrates that, more than one third of participants among both group (1) and group (2) were suffering from diabetes and hypertension (36.7% &36.7% ; 43.3%& 36.7%) respectively.

Table (2): Displays that, the dyspnea total mean score among participants in group (1) who received ANB exercise significantly improved to be 22.7±4.8post intervention compared to 33.0±3.3 pre intervention. There was statistical significant difference pre and post intervention among participants in group (1) in dyspnea total mean scores (t= 11.196, p=0.000**).

Table (3): It is noteworthy that, the fatigue total mean score among participants in group (1) who received ANB exercise significantly decreases from 79.2±9.0pre intervention to 51.5±11.4post intervention. There was statistical significant difference pre and post intervention among studied participants in group (1) in fatigue total mean score (t=12.692, p=0.000**).

Table (4): Reveals that, the dyspnea total mean score among studied participants in group (2) who received DB exercise significantly decreased from 33.9±4.7 pre intervention to 20.4±5.3post intervention. There was statistical significant difference pre and post intervention among studied participants in group (2) in dyspnea total mean scores (t=9.945, p=0.000**).

Table (5): Shows that, the fatigue total mean score among studied participants in group (20who received DB exercise significantly decreases to44.1±7.7 post intervention compared to 78.2±9.1 pre intervention. There was statistical significant difference pre and post intervention among studied participants in group (2) in fatigue total mean score (t=15.918, p=0.000**).

Table (6): Portrays that, there was no statistical significant difference between group (1) and group (2) in dyspnea total mean score pre and post intervention were(t= .830,p=.410&t=1.723 , p=.090) respectively. The dyspnea total mean score in group (1) and group (2) were(33.0±3.3; 33.9±4.7&22.7±4.8; 20.4±5.3) respectively pre and post intervention respectively.

Table(7): Reveals that, pre intervention there was no statistical significant difference between group (1) and group (2) in fatigue total mean score (t=.456,p=.650), the fatigue total mean score in group (1) and group (2) was (79.2±9.; 78.2±9.1) respectively. While, the current result found that, there was statistically significant difference between group (1) and group (2)in fatigue total mean score post intervention (t=2.910,p=0.005*), the fatigue total mean score in group (1) and group (2) was (51.5±11.4;44.1±7.7) respectively.

Table (1): Socio- demographic characteristics and medical related data among participants (n=60)

Items	Group (1) ANB		Group(2)DB		Test of significance	P-value
	N (30)	%	N (30)	%		
Age: 20 - < 40 40 –60	9 21	30 70	7 23	23.3 76.7	t 0.073	0.942
Mean ± SD	46.46 ± 11.86		46.23 ± 12.83			
Gender: Male Female	12 18	40 60	9 21	30 70	X^2 0.658	0.50
Smoking habit Smoker Non smoker	12 18	40 60	9 21	30 70	X^2 0.658	0.50
Marital Status: Married Not married	18 12	60 40	22 8	73.4 26.6	X^2 1.2	0.20
Educational level: Read and write Can't read and write	18 12	60 40	17 13	56.7 43.3	X^2 0.068	0.90
Occupation: Working Not working	6 24	20 80	10 20	33.3 66.7	X^2 1.332	0.25
Residence: Rural Urban	5 25	16.7 83.3	10 20	33.3 66.7	X^2 2.22	0.1
Duration of asthma Less than one year 1- <5 5 & more	9 12 9	30 40 30	10 8 12	33.3 26.7 40	X^2 2.928	0.50

Result is significant at p-value ≤ 0.05

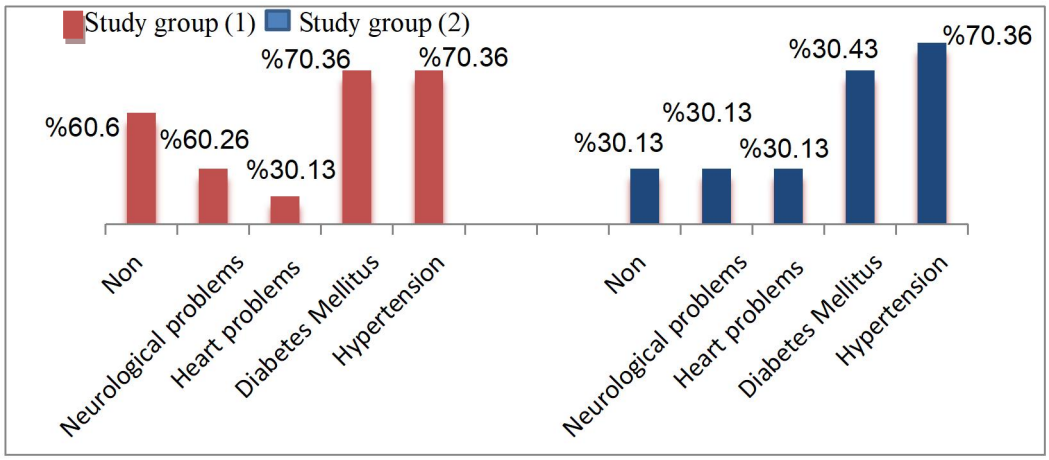

Figure (1): Co- morbid diseases among participants in both groups (1) &group (2).

Table (2): Total mean score of dyspnea severity in studied group (1) pre and post intervention, (n=30)

Dyspnea domain	Group (1) ANB			
	Pre	Post	t-test	p-value
	Mean ± SD	Mean ± SD		
Physical dyspnea	19.1±2.1	13.2±2.8	10.616	0.000**
Affective dyspnea	13.9±1.4	9.5±2.0	11.162	0.000**
Total dyspnea score	33.0±3.3	22.7±4.8	11.196	0.000**

t paired test *** Result is highly significant at p-value≤0.001*

Table (3): Total mean score of fatigue severity in studied group (1) pre and post intervention, (n=30)

Fatigue domain	Group (1) ANB			
	Pre	Post	t-test	p-value
	Mean ± SD	Mean ± SD		
General fatigue	26.6±2.7	17.2±3.7	13.443	0.000**
Fatigue interfere with health	53.7±6.5	34.3±7.8	12.571	0.000**
Total fatigue score	79.2±9.0	51.5±11.4	12.692	0.000**

t paired test *** Result is highly significant at p-value≤0.001*

Table (4): Total mean score of dyspnea severity in studied group (2) pre and post intervention, (n=30)

Dyspnea domain	Group (2) DB			
	Pre	Post	t-test	p-value
	Mean ± SD	Mean ± SD		
Physical dyspnea	18.9±2.3	12.1±3.3	7.856	0.000**
Affective dyspnea	14.3±1.3	8.5±2.3	11.645	0.000**
Total dyspnea score	33.9±4.7	20.4±5.3	9.945	0.000**

t paired test *** Result is highly significant at p-value≤0.001*

Table (5): Total mean score of fatigue severity in studied group (2) pre and post intervention,(n=30)

Fatigue domain	Group (2) DB			
	Pre	Post	t-test	p-value
	Mean ± SD	Mean ± SD		
General fatigue	25.3±3.6	14.7±2.5	14.176	0.000**
Fatigue interfere with health	52.9±5.9	29.4±5.5	15.966	0.000**
Total fatigue score	78.2±9.1	44.1±7.7	15.918	0.000**

t paired test *** Result is highly significant at p-value≤0.001*

Table (6): Comparison of total mean score of dyspnea severity between studied group (1)&studied group (2) pre and post intervention(n= 60*).*

Dyspnea domain	Group (1) ANB	Group (2) DB	t-test	* p-value
	Mean ± SD	Mean ± SD		
Pre-intervention				
Physical dyspnea	19.1±2.1	18.9±2.3	0.289	0.773
Affective dyspnea	13.9±1.4	14.3±1.3	1.058	0.295
Total dyspnea score	33.0±3.3	33.9±4.7	0.830	0.410
Post-intervention				
Physical dyspnea	13.2±2.8	12.1±3.3	1.377	0.174
Affective dyspnea	9.5±2.0	8.5±2.3	1.779	0.081
Total dyspnea score	22.7±4.8	20.4±5.3	1.723	0.090

t paired test * Result is significant at p-value≤0.05*

Table (7): Comparison of total mean score of fatigue severity between studied group (1) &group (2) pre and post intervention, (n= 60).

Fatigue domain	Group (1) ANB	Group (2) BD	t-test	*p-value
	Mean ± SD	Mean ± SD		
Pre-intervention				
General fatigue	26.6±2.7	25.3±3.6	1.620	0.111
Fatigue interfere with health	53.7±6.5	52.9±5.9	0.497	0.621
Total fatigue score	79.2±9.0	78.2±9.1	0.456	0.650
Post-intervention				
General fatigue	17.2±3.7	14.7±2.5	2.980	0.004*
Fatigue interfere with health	34.3±7.8	29.4±5.5	2.810	0.007
Total fatigue score	51.5±11.4	44.1±7.7	2.910	0.005*

t paired test * Result is significant at p-value ≤ 0.05**

Discussion:

The study results clarified that the high percent of the two studied group aged between 40 to 60 years old, females, married, able to read and write, not working and live in urban areas. These findings are consistent with earlier findings presented in literature by **Hamad, Hadi, Mohr, Mahadevan, & Kzar (2023); Hashem, &Yakout (2020)** they denoted that the majority of their participants had the same characteristics. On the other hand, in relation to gender, the current finding are not supported by **Mohamed & Mohamed (2023); Shabaan, Daabis, Abdelhady, &**

Ibrahim (2021) who reported that the prevalence of asthma in Egypt is higher in male than female.

The factor that might contributed to this finding regarding age and was recognized from the literature as well, the airways of those age group are more easily irritated by environmental triggers such as dust, pollen, and smoke. Regards place of residence, the current study result is matched as well with a recent study carried out in Egypt conducted by **El-Sherif, El-Sayed, Mohsen, Elsharkawy, &Fahmy (2020)** who reported that frequency of asthma in Egypt is higher in urban areas than rural areas. This may be due to a number of factors, including air pollution and exposure to allergens is higher in urban areas.

The results of the current study revealed that more than one third of group (1) is suffering from asthma for one year to less than five years, while about one third of study group (2) is suffering from asthma for more than five years. These finding was similar with previous study conducted by **Hassan, Mostafa & Mohamed (2020**) that reported more than half of their participants were suffering from asthma for six to ten years. Moreover, these finding wasn't supported by **Pauline, Bosco, Bellancille, Evelyne, & Claude (2021)** in their study about "Asthma Severity and Self-Care Practices among Asthma Participants" reported that, the majority of samples have been living with asthma for above 11 year.

Regards smoking habits, the current study revealed that the high percent of both group (1) & group (2) is non-smoker; this finding is in the same line with by **Hamad, et al. (2023); Hashsem, &Yakout (2020).** In the authors' opinion, a possible explanation for this phenomenon could be related to the fact that smoking is less common among female participants in Egypt. In relation to co-morbid diseases, the current study documented that, more than one third of participants among both group (1) and group (2) were suffering from diabetes and hypertension, these findings are consistent with the study findings by **Khedr, et al.(2022);Hassan et al. (2020)**. In the authors' opinion and lending support to this explanation what was reviewed in the literature that the prevalence of comorbidities increases with advancing age.

Concerning H_1, the current study revealed that, there were statistically significant differences between dyspnea mean scores (physical, affective and total) and fatigue mean scores (general, fatigue interference and total) pre and post intervention among participants in study group (1). These findings are supported by previous studies conducted by Bargal**, Nalgirkar, Patil, Langade, &Langa (2022); Jahan et al. (2022)** which studied effects of alternate nostril breathing exercise on cardio-respiratory functions and reported that ANB can be recommended for increasing cardio-respiratory efficiency. Several factors may have played a role in the observed phenomenon and were documented in the literature, first, ANB equilibrium the activity of the sympathetic and parasympathetic nerves, so that breathing become stable, and participants does not feel shortness of breath anymore. Second, this type of breathing exercise can equilibrium the left and right sides of the brain, also calm the nervous system, so that it can decrease heart rate, stress and anxiety and progress respiration and circulation **(Simandalahi, Morika, &Fannya, 2019).**

In the same context, the above mentioned findings related to fatigue severity are matched with **Weheda, Elsayed Khatab,**

& Abdel Mowla (2021) who carried out a study about "Effect of an Alternate Nostril Breathing Exercise on Fatigue and Quality of Sleep Pattern among Nursing Students" reported that, there were experienced decrease levels of fatigue among Nursing Students. Another study conducted by **Panwar, Chourishi, Makwana (2020)** who studied the effect of alternate nostril breathing on fatigue in participants with chronic fatigue syndrome and reported ANB group had significantly reduction in fatigue mean scores than the control group. In the authors' opinion, the significant reduction in fatigue mean scores was related to decline in dyspnea severity as it is the most debilitating symptom of asthma that significantly affected participants' wellbeing.

Regards H_2, there were statistically significant differences between dyspnea mean scores (physical, affective and total) and fatigue mean scores (general, fatigue interference and total) pre and post intervention among participants in study group (2), these findings is supported by **Busko, & White, (2018); Amola, Pawara, &Kalra(2019)** who found that diaphragmatic breathing exercise is an effective way to reduce dyspnea and fatigue severity. Moreover, **Astuti, &Huriah (2022)** who carried out a study titled "Combination of diaphragmatic breathing with therapeutic walking exercise to increase peak expiratory flow rate in asthma participants" reported that diaphragmatic breathing improved exercise tolerance level and decreased dyspnea level. Another recent study conducted by **Triocha, & Akbar (2023)** in title "Application Diaphragmatic Breathing Exercise on Dyspnea Participants With Pneumonia" reported that there was a decrease in the degree of dyspnea in pneumonia participants after being given the application of the diaphragmatic breathing exercise.

In relation to H_3, post intervention, there wasn't statistically significant differences between total mean score of dyspnea between study group (1) &study group (2). While, there was a significant difference in fatigue severity total mean scores between group (1) & group (2), with second group having lower fatigue severity mean score post intervention. Since, the current study is considered the first study to present findings related to which exercise from ANB or DB has a better effect on severity of dyspnea and fatigue, in the author's opinion, the two exercises help in air flow into the body efficiently, but on the other hand, the technique of diaphragmatic breathing is less fatigable than technique of alternate nostril breathing.

Conclusion

Based on the current study findings, alternate nostril breathing and diaphragmatic breathing both are effective breathing exercises for improving dyspnea and fatigue among asthmatic participants. However, diaphragmatic breathing appears to have a greater effect on reducing fatigue severity compared to alternate nostril breathing. Diaphragmatic breathing is a simple and convenient breathing exercise that can be practiced anywhere, anytime. It is a safe and effective way to manage asthma symptoms, and it can be used to improve both quality of life and physical function.

Recommendations:

The following recommendations are proposed based on the study findings:

- Conduct larger studies with longer follow-up periods to confirm the long-term effectiveness of ANB and DB for asthma.

- Compare the effectiveness of ANB and DB to other asthma treatments, such as asthmatic medication.
- Develop and implement standardized protocols for teaching ANB and DB to asthma participants.

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